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OFFSHORE TRANSPORT AND DIFFUSION IN THE LOS ANGELES BIGHT - I, --ETC(U)
1980 G E SCHACHER, K L DAVIDSON

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OFFSHORE TRANSPORT AND DIFFUSION IN THE
LOS ANGELES BIGHT - I, NPS DATA SUMMARY

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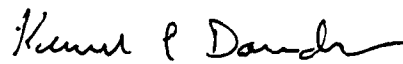
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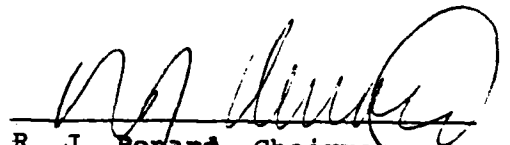


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I. Introduction

During September of 1980 the Environmental Physics Group of the Naval Postgraduate School (NPS) and Aerovironment, Inc. conducted a research program in the Santa Barbara Channel area of the California coast. The purpose of the operation was to perform offshore tracer experiments in order to parameterize dispersion models that are in current use and to build a data base for future model development. The purpose of this report is to present the pertinent meteorological and source data for use by those who will be involved in the modeling effort. Only the basic data, reduced to engineering units, will be presented here; interpretation of these data and application to the models will be the subject of a future joint report by Aerovironment and NPS.

Although the data gathered in this experiment has much wider application, it was collected for the specific purpose of parameterizing models that will be used to assess the onshore impact of offshore oil exploration and production sites. Such impact currently has great importance since many coastal areas are near the legal air pollution limit and any significant additional loading could push them over the limit. Air pollution models in current use have not been adequately validated for the overwater regime. The results of this study should remedy the inadequacy of the models.

During the tracer experiments SF_6 gas was released from the ship RV/Acania and tracked by an aircraft, a small boat, and one mobile and fixed stations on shore. Meteorological data was gathered on the ship and on the shore. This report contains shipboard meteorological - data and gas source strength. Shore meteorological data and tracer results can be found in a report by Aerovironment.

II. Ship Operation Scenario

Since the impact of offshore sources on the shore is the purpose of these investigations the experiments must be performed during periods of onshore winds. These winds must be of a fairly long duration since it takes a minimum of 6 hours to gather enough data during any one experiment. The preliminary decision to release the tracer gas on any given day must be made on the previous day due to the time needed to prepare all of the sampling sites. Thus, the following schedule was used.

All Days

1. 0800-1200-2000: radio shipboard meteorological data to shore.
2. 1000: Shore obtains weather forecast from Point Mugu.
3. 1200: shore command center makes a go/no-go decision for a release on the following day.

Release Day

4. 0700: begin hourly wind reports to shore.
5. 1000: decision on release made by ship-shore communication, final decision made on shore.
6. Final positioning of ship.
7. 1100: start tracer gas release.
8. 1900: end tracer gas release and hourly wind reports.

The exact timing of the release varied somewhat and was two hours later for one of the tests because of wind conditions.

Because of difficulty in moving the shore stations, targeting of the plume was accomplished by moving the ship. This had to be done before the release was begun because moving the ship would introduce wander into the plume trajectory and contaminate the results. In order to hold the ship stationary to the degree needed it was anchored during a release.

Significant Events:

At times the ship was performing tasks not directly associated with this study or was in port. As an aid in interpreting the data we list times of "significant shipboard events".

9/21	0905	Underway from Monterey
9/22	1030	Arrive at operation area
	1225	Underway to Anacappa Island
	1400-1700	Drift in Anacappa passage
	1700	Move to open channel
	1930	On station at operation area
9/25	1000	Underway for Port Hueneme
	1118	Dock
9/27	0500	Underway
	0640	Arrive at operation area
9/28	1930	Underway for Port Hueneme
	2030	Dock
9/29	0500	Underway
	0615	Arrive at operation area
	1930	Underway for Port Hueneme
	2030	Dock
9/30	1015	Underway
10/1	1010	Arrive at operation area
	1630	Depart for Monterey

Table 1 - Significant Shipboard Events

III. Shipboard Equipment

We give here a brief description of the meteorological measurements that were made on the ship. Details of the equipment and calibration procedures can be found in a previous report. Two meteorological stations at heights of 7 m and 20.5 m above mean sea level were used. At each level the following parameters were measured:

relative wind speed

relative wind direction (upper level only)

air temperature

dew point

wind speed fluctuation

The following parameters were also measured:

sea surface temperature

ship roll

ship location

inversion height

temperature and humidity profiles to 5,000 ft.

sky cloud cover

The temperature and humidity profiles were obtained by shipboard radiosonde launch and were taken every 12 hours. The temperature inversion height was determined by an acoustic sounder which gave a continuous strip chart record. Most data listed above was averaged for one half hour intervals. The exceptions were relative wind direction and ships roll. For both, 10 sec averages were obtained and recorded for the full period of a gas release.

IV. Tracer Release Data

Four separate experiments were performed. For each the gas was released through the exhaust of one of the ship's diesel motors. The main engine was used first but the cool gas injection caused a slight crack in the exhaust pipe so the exhaust of one of the motor generator sets was used for subsequent releases. Both exhausts are inclined at an angle of 45° above the horizontal. Both engines are 2 cycle diesels so exhaust flow rate is obtained by multiplying 2/3 times the displacement times the revolutions per minute. The pertinent data to characterize plume rise are:

<u>Release Numbers</u>	<u>rpm</u>	<u>displacement (Cu in)</u>	<u>Stack Temp. (°F)</u>	<u>Flow Rate (cu in/sec)</u>	<u>Diameter (in)</u>
1	1250	860	210	9.17×10^3	8
2,3,4	1500	426	250	7.13×10^3	4.5

Table 2. Characteristics of exhausts used during tracer gas releases.

For a release, 4 tanks of SF_6 were connected to a single manifold. The manifold has a pressure gauge and two rotometers, one supplied by the manufacturer and one calibrated and supplied by Aerovironment. The second meter was used to set the flow rate the first to monitor it since it was less subject to fluctuations. The gas pressure to the rotometers was maintained at 25 lbs/in².

Using the data found in Table 3 the flow rates for the four releases were

Release 1	49.01	lbs/hr
Release 2	50.74	lbs/hr
Release 3	48.54	lbs/hr
Release 4	47.91	lbs/hr

During the releases the ship was anchored approximately 5 Nmi SWW of Ventura. As stated above the releases started at approximately 1100 and ended at approximately 1900. The exact times and locations are given in Table 3.

<u>Release</u>	<u>Date</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Start Time</u>	<u>End Time</u>
1	9/24	34°14.2'N	119°21.1'W	1135	1900
2	9/27	34°14.8'N	119°21.1'W	1107	1815
3	9/28	34°14.2'N	119°21.1'W	1243	1900
4	9/29	34°12.8'N	119°20.4'W	1143	1900

Table 4. Exact locations and start and end times for each release. Times are local, Pacific Daylight Time.

<u>Bottle Number</u>	<u>Initial Weight (lbs)</u>	<u>Release 1</u>	<u>Release 2</u>	<u>Weight after Release 3</u>	<u>Release 4</u>
1	255	164			
2	256	166			
3	252	159.5			
4	254	164	140.5		
5	257.5		145		
6	253		141		
7	253		139		
8	278				
9	260.5				
10	256.5			158.5	
11	256			152.5	
12	255			151.5	
13	257				144
14	254				140
15	251.5				139
16	257				<u>247.5</u>
Release time		7:25	7:08	6:17	7.17

Table 3. SF₆ bottle weights before and after the four releases. The total times for each release are also given.

V. Wind Histories

Recent histories of wind direction and speed can be very useful for predicting winds on a short term basis as long as the synoptic situation does not change. For this operation winds were recorded and plotted at least every hour in the experimental area. These plots, shown in Figures 1, were very useful in the go/no-go decisions for release days.

The local situation during the time of the operation was one of light and variable winds. During the late night and early morning the wind was generally easterly, switching to onshore flow in the late morning or early afternoon. If the changeover was too late, or the winds too light a tracer gas experiment could not be performed. As can be seen from the figures, the time at which the wind direction began to change, and the rapidity of the wind speed magnitude change, is a good predictor of the ultimate direction and speed.

Figure 1a

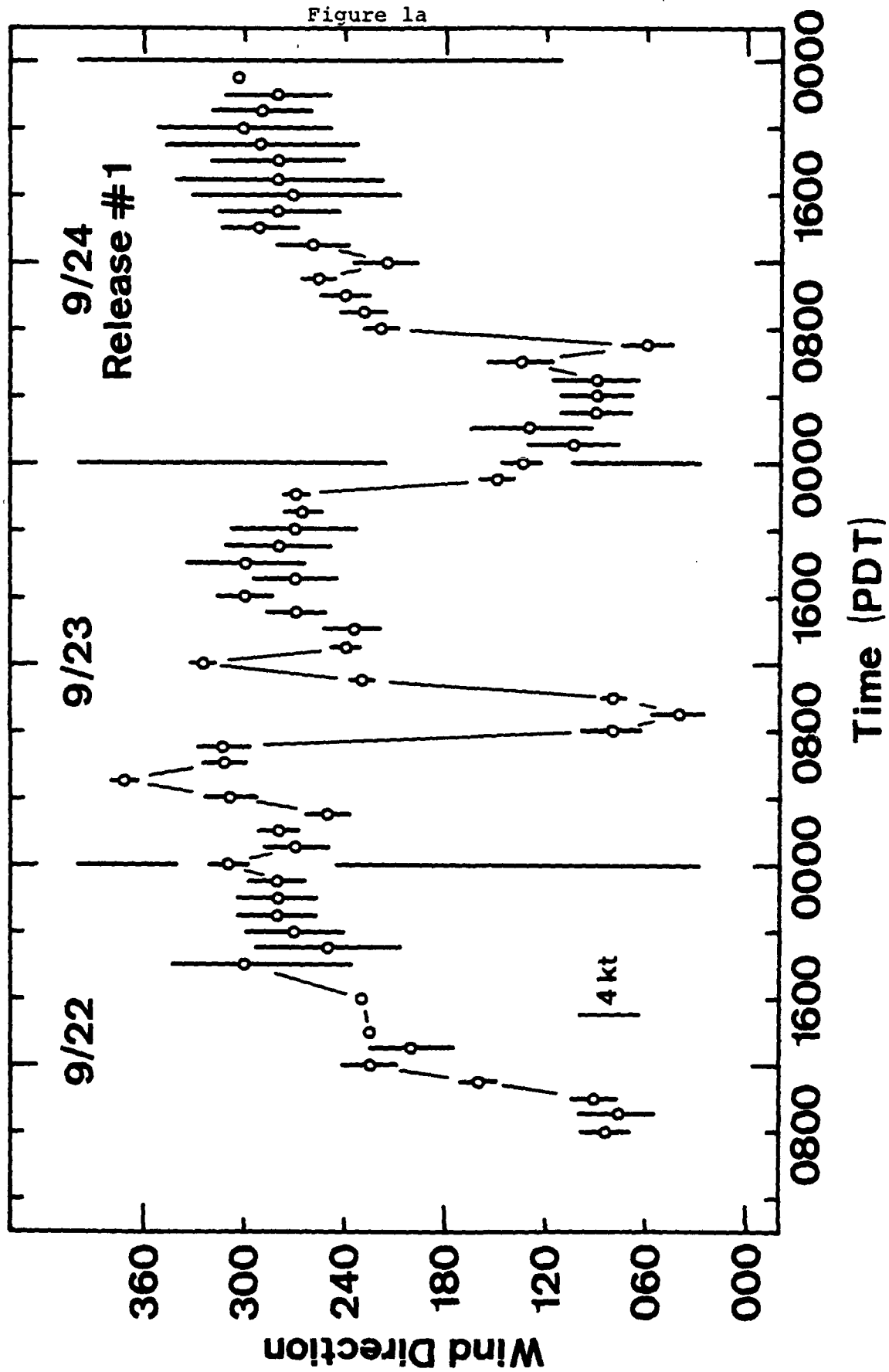
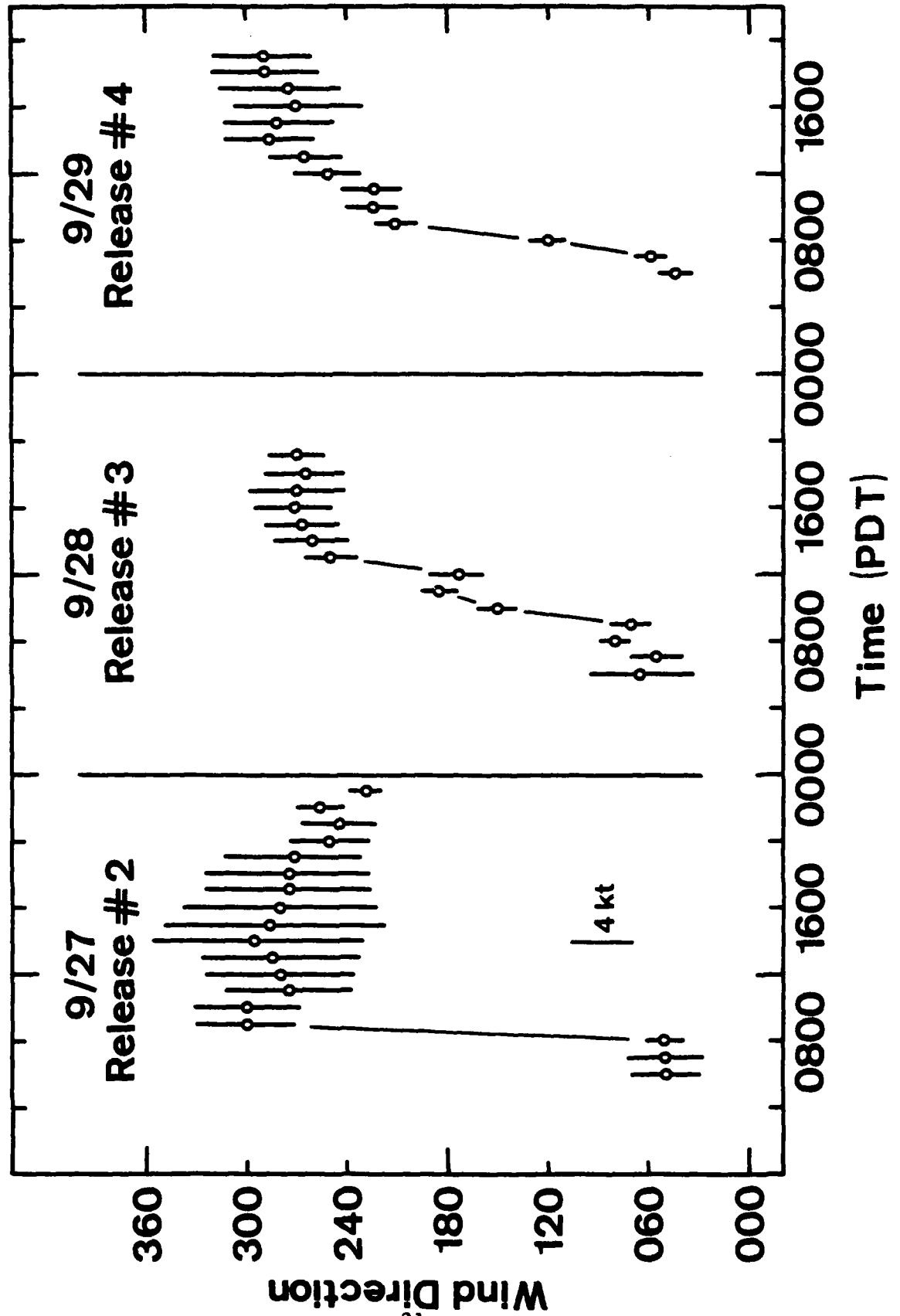


Figure 1b



VI. Radiosonde Results

Radiosondes were released from the ship twice in each 24-hour period, generally at 0000 and 1200 PDT.

Releases were made and interpreted by a Navy radiosonde team. Temperature and humidity were determined at standard levels and significant points. Since we are interested in the detailed structure of the boundary layer such a treatment is too coarse. Thus, the original strip chart output and the met team determined calibration points were used to construct fine scale graphs, which are presented in Figures 2.

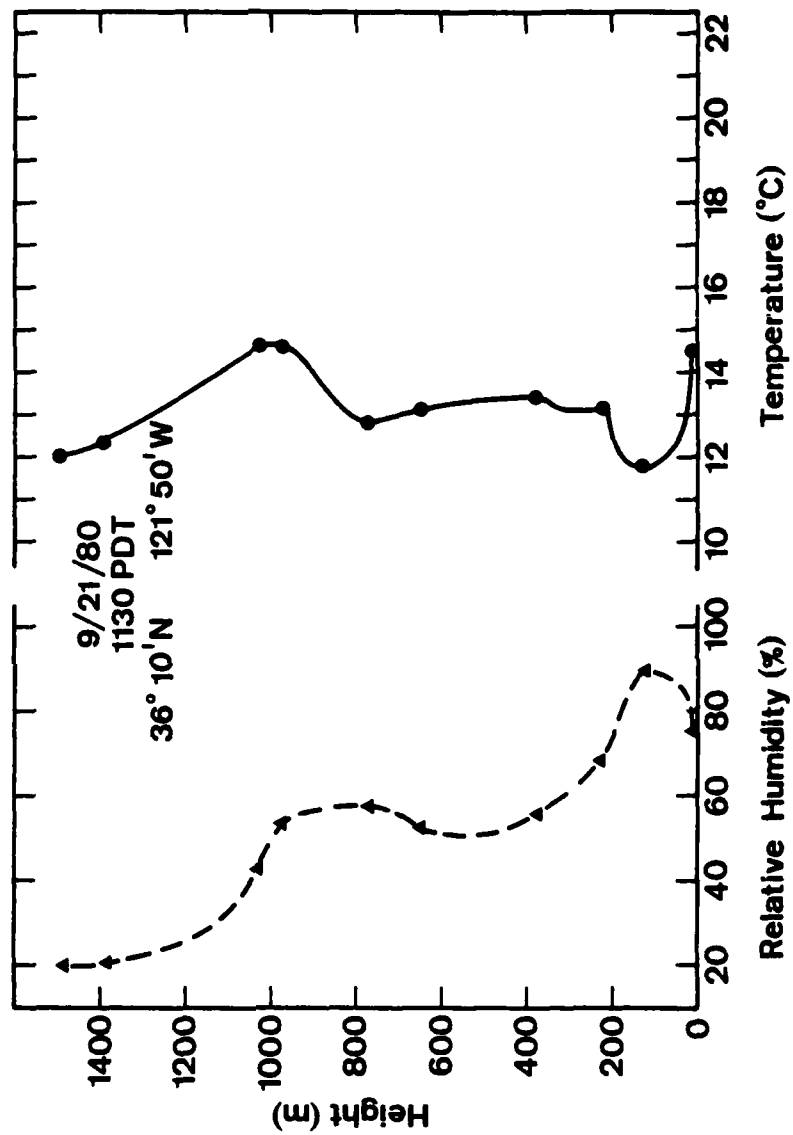


Figure 2a

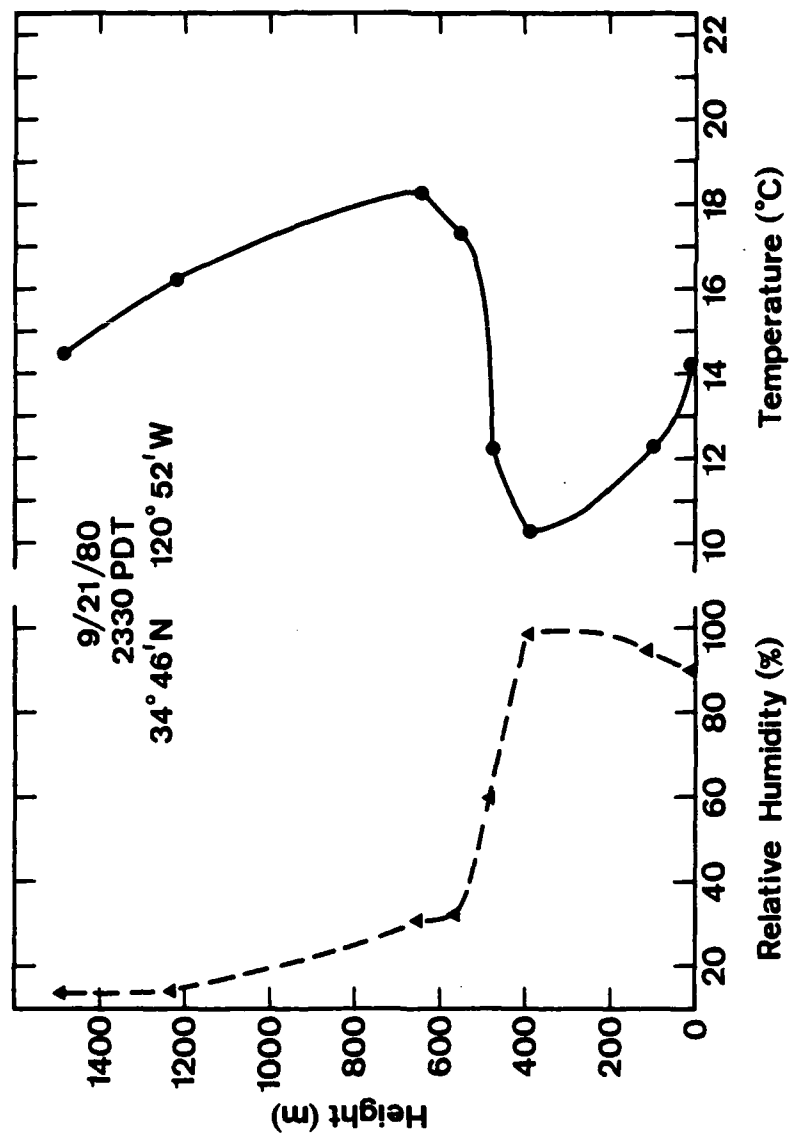


Figure 2b

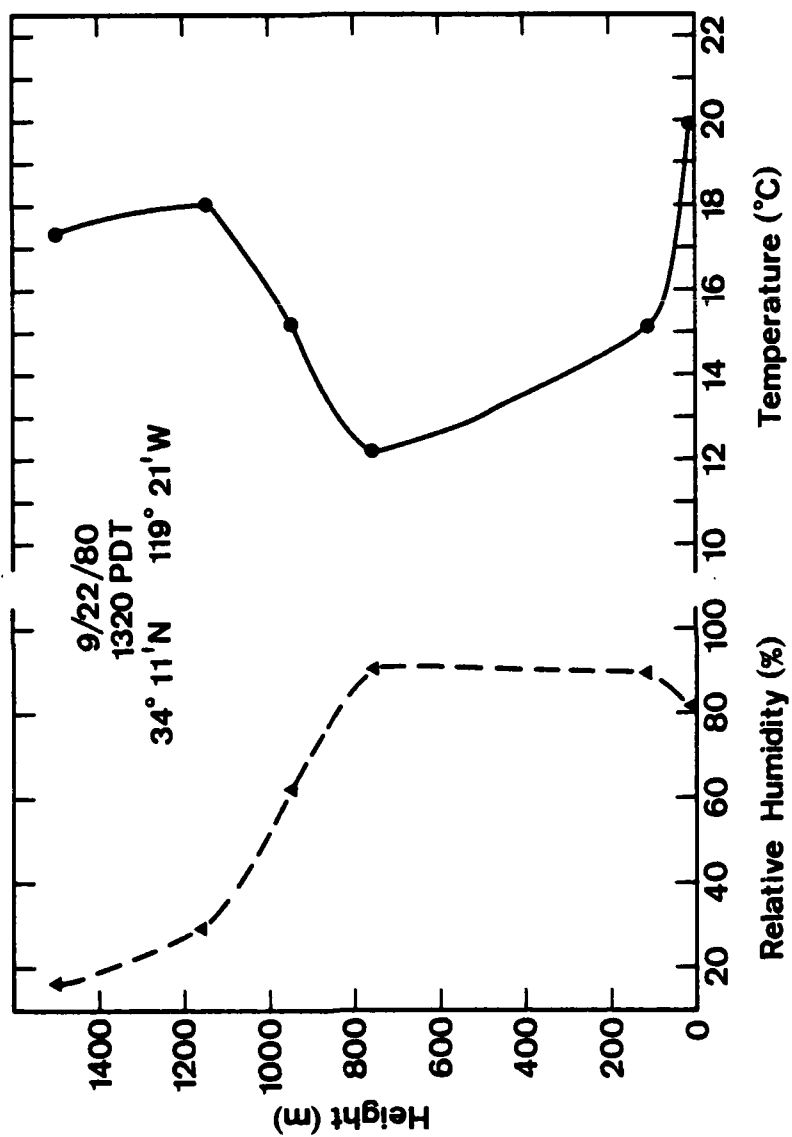


Figure 2c

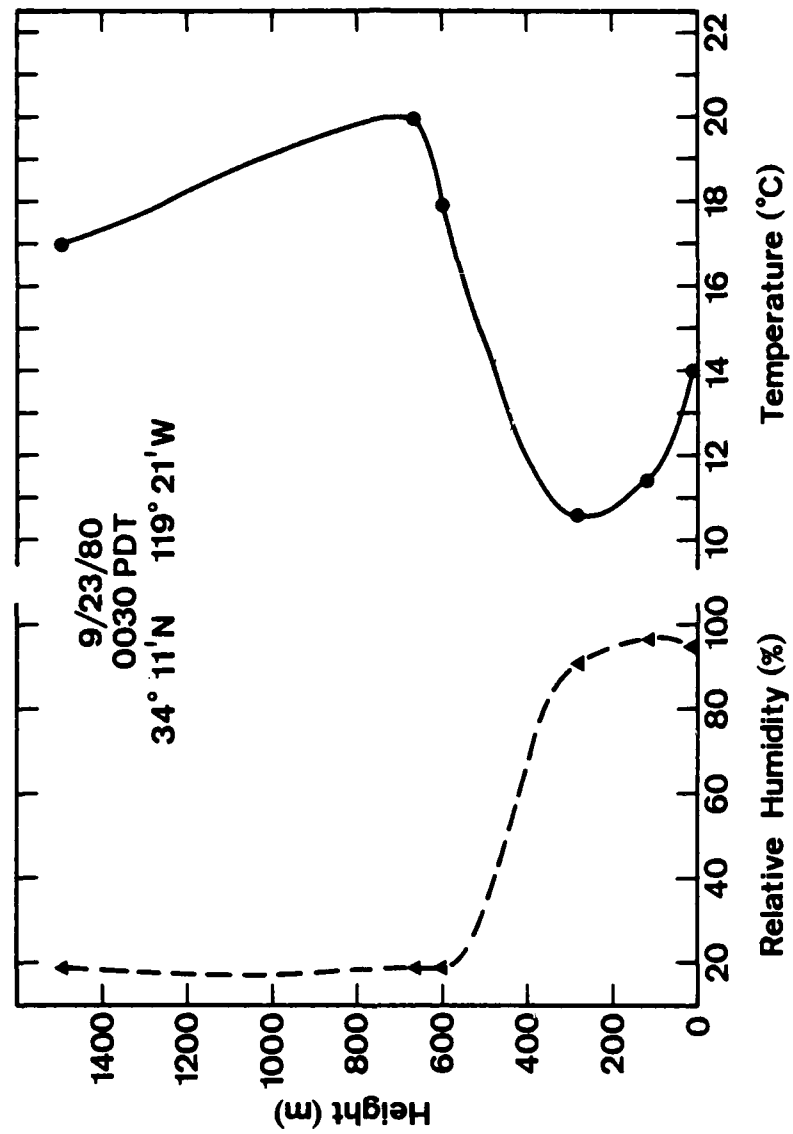


Figure 2d

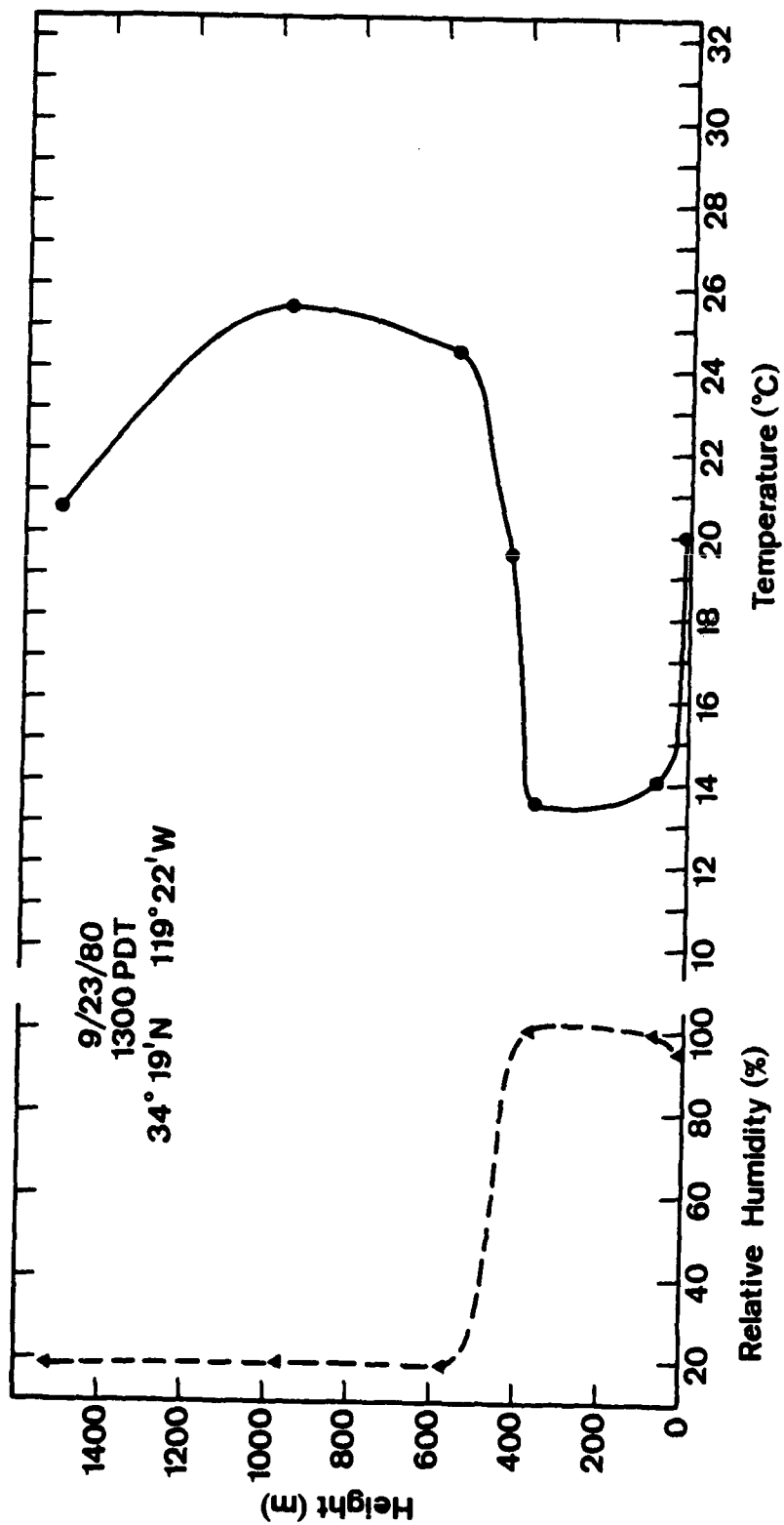


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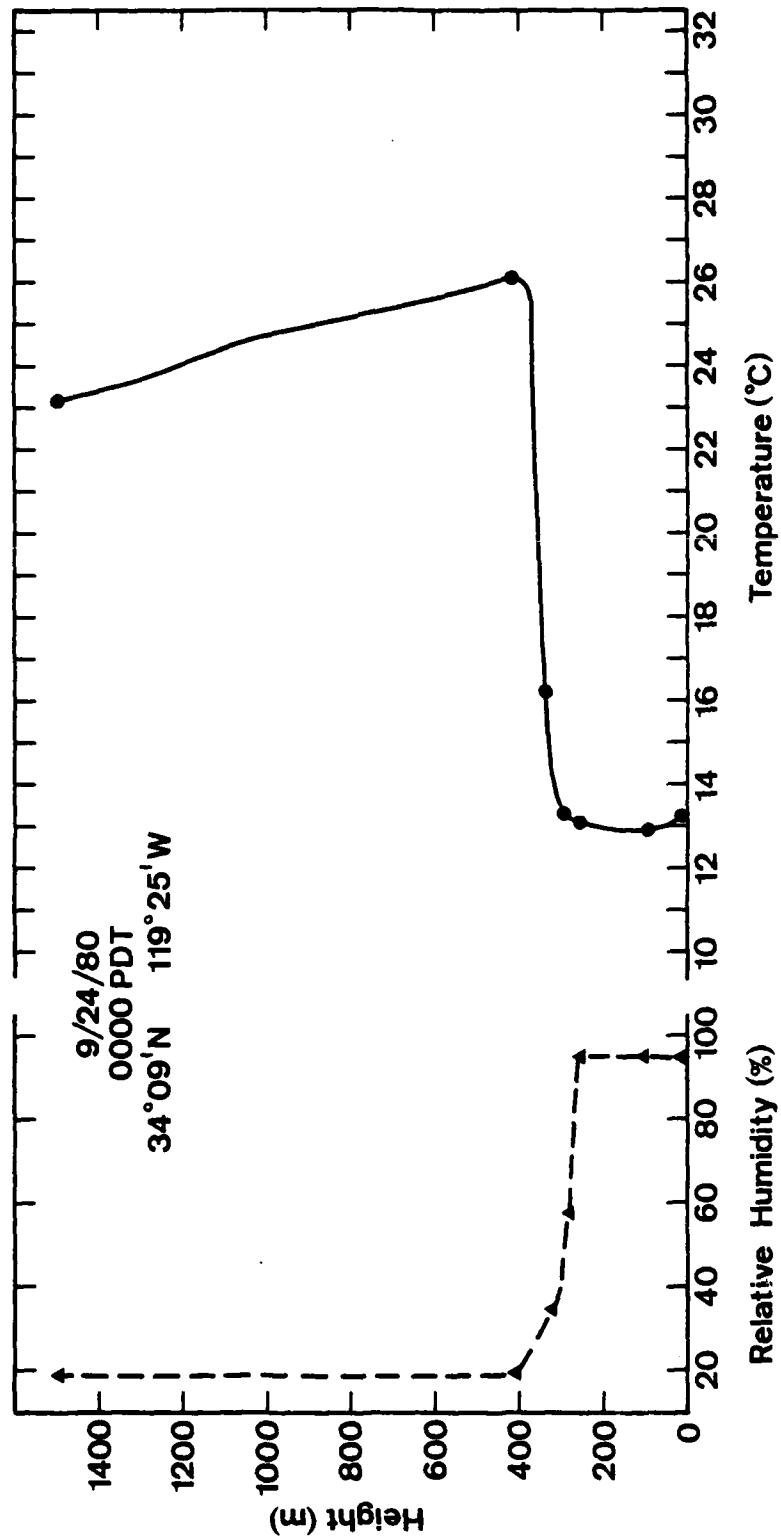


Figure 2f

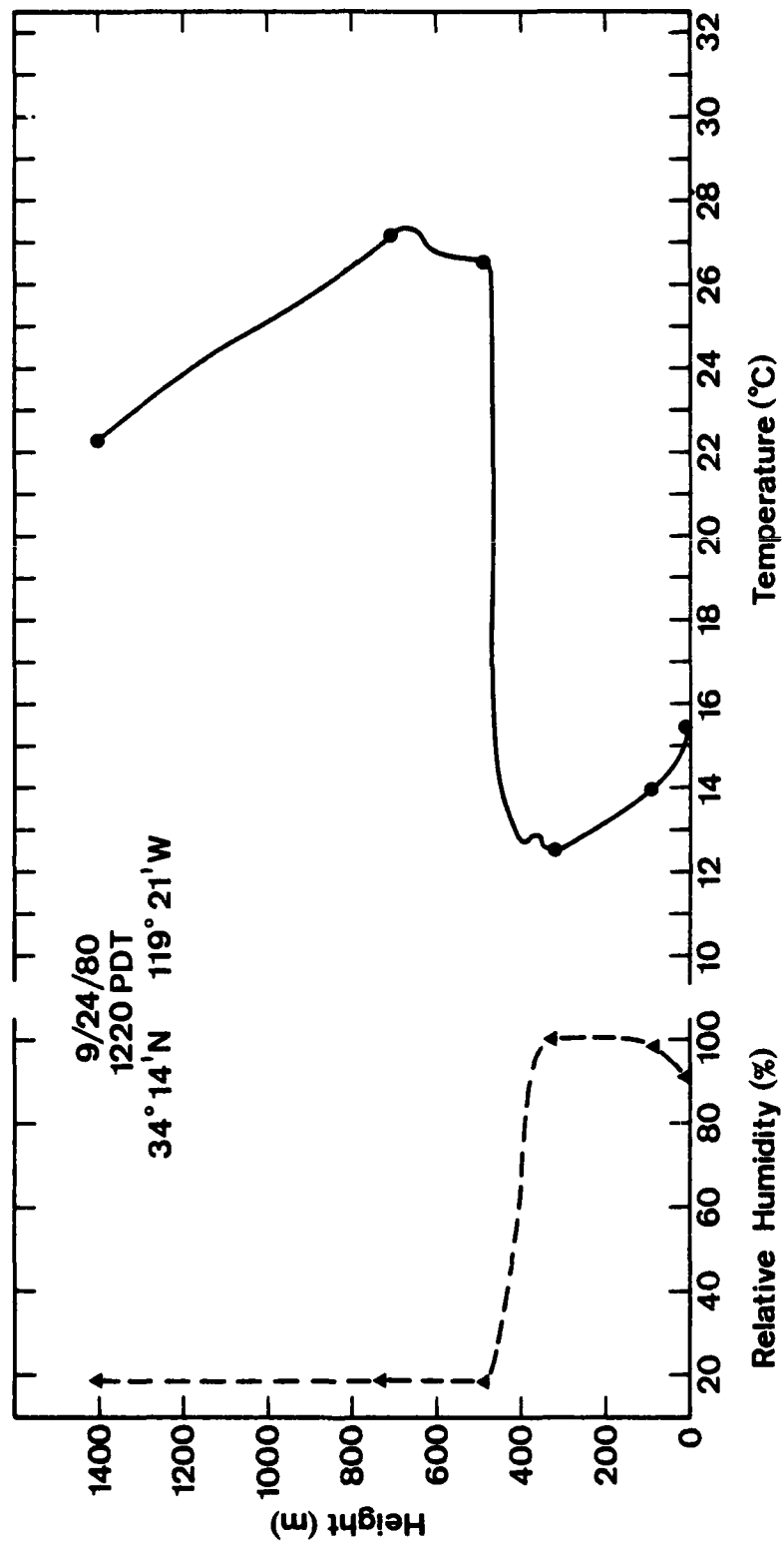


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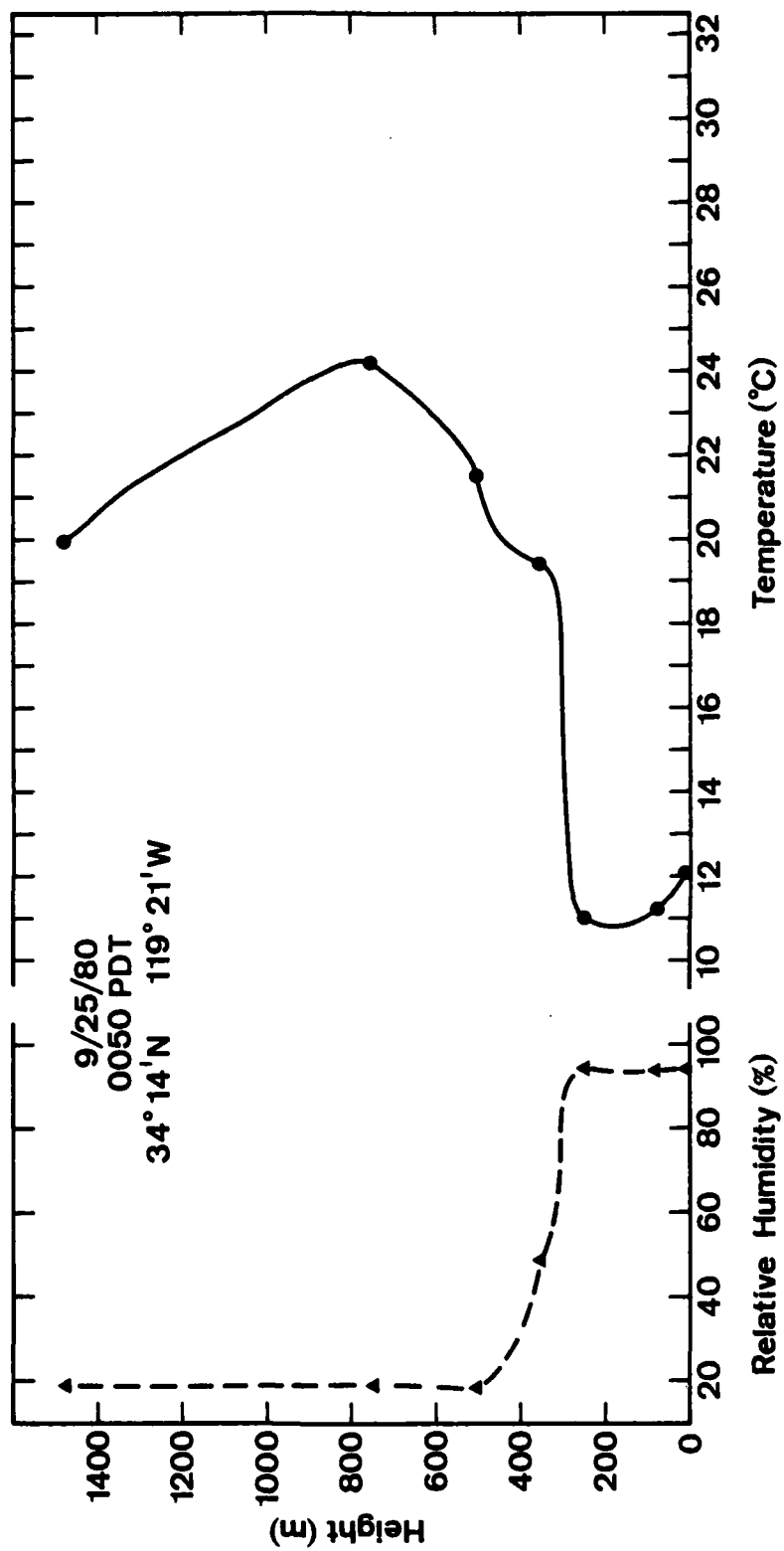


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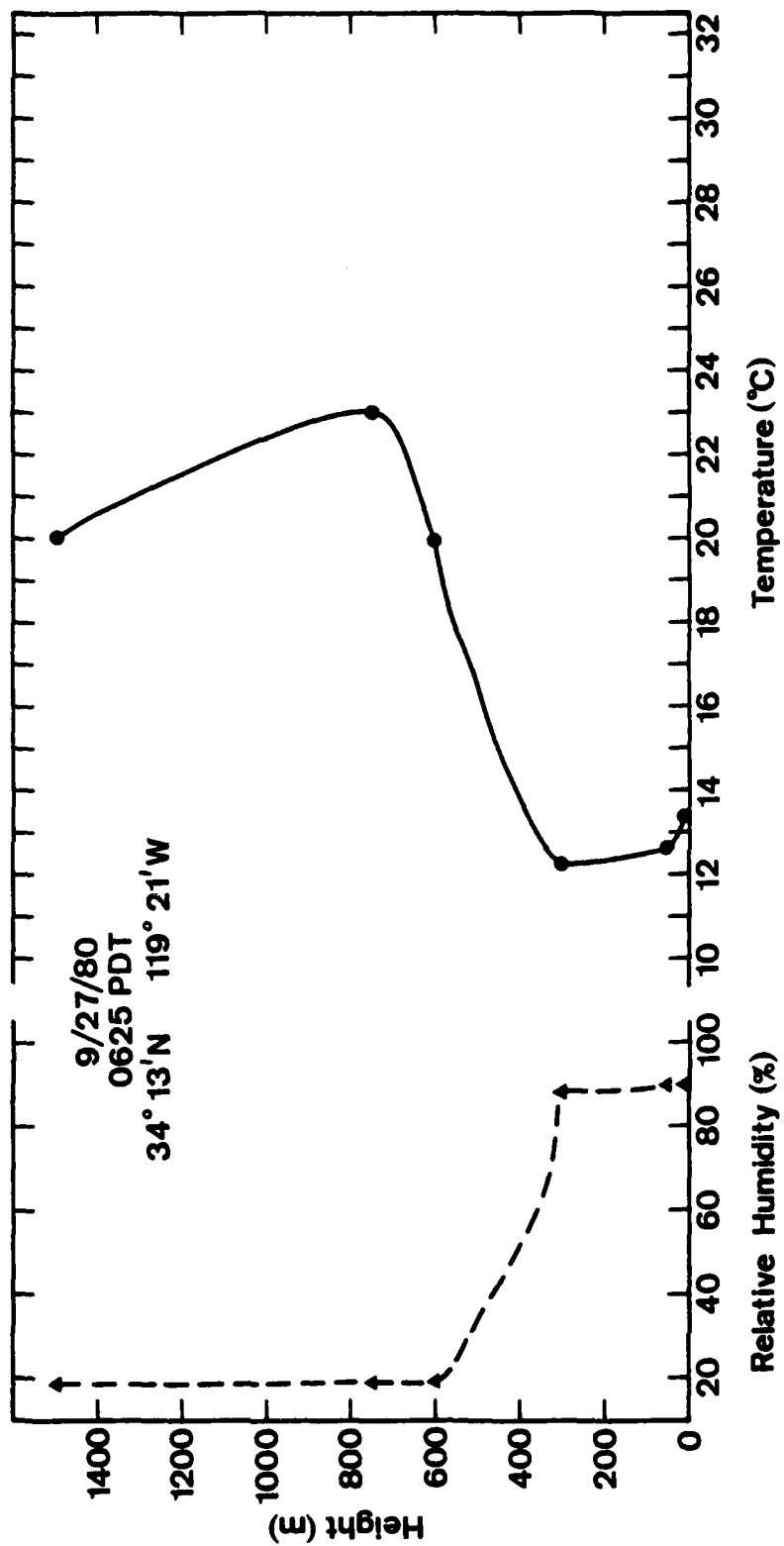


Figure 2i

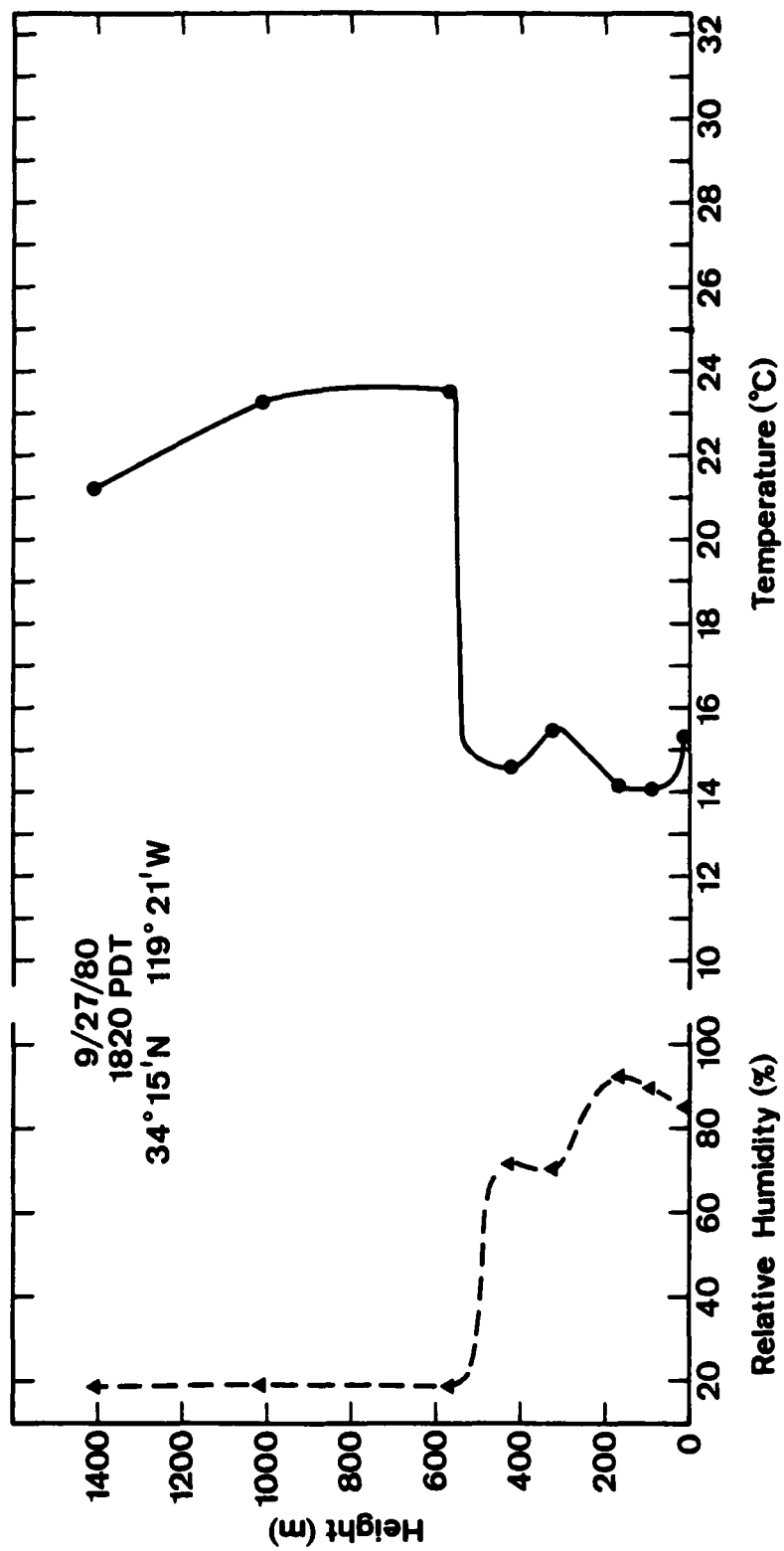


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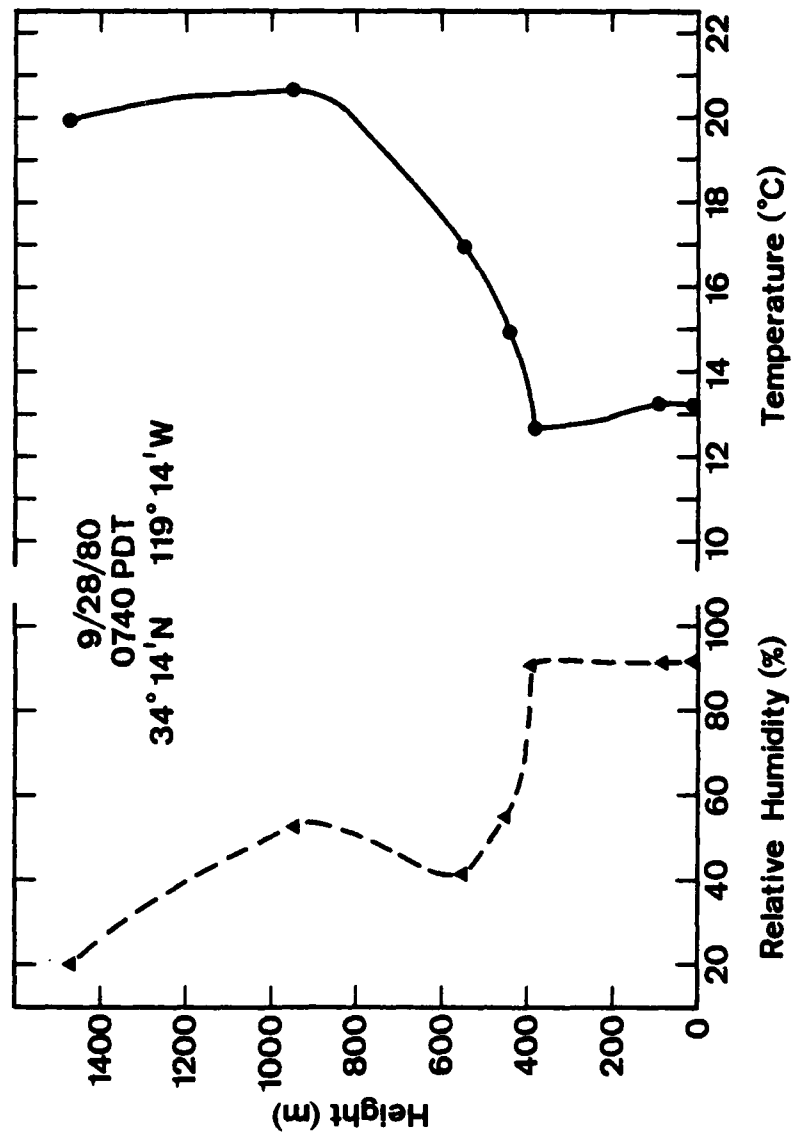


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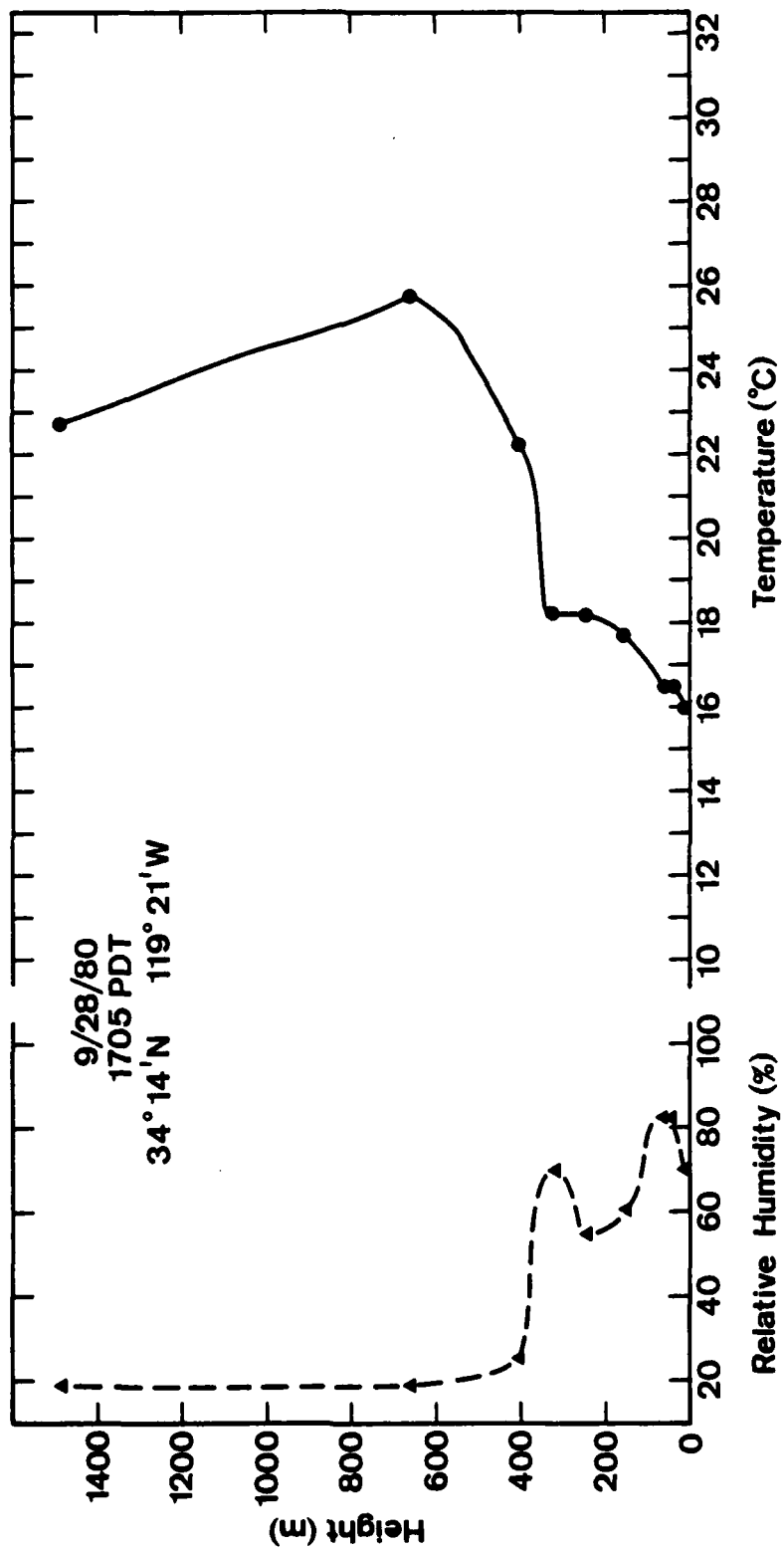


Figure 21

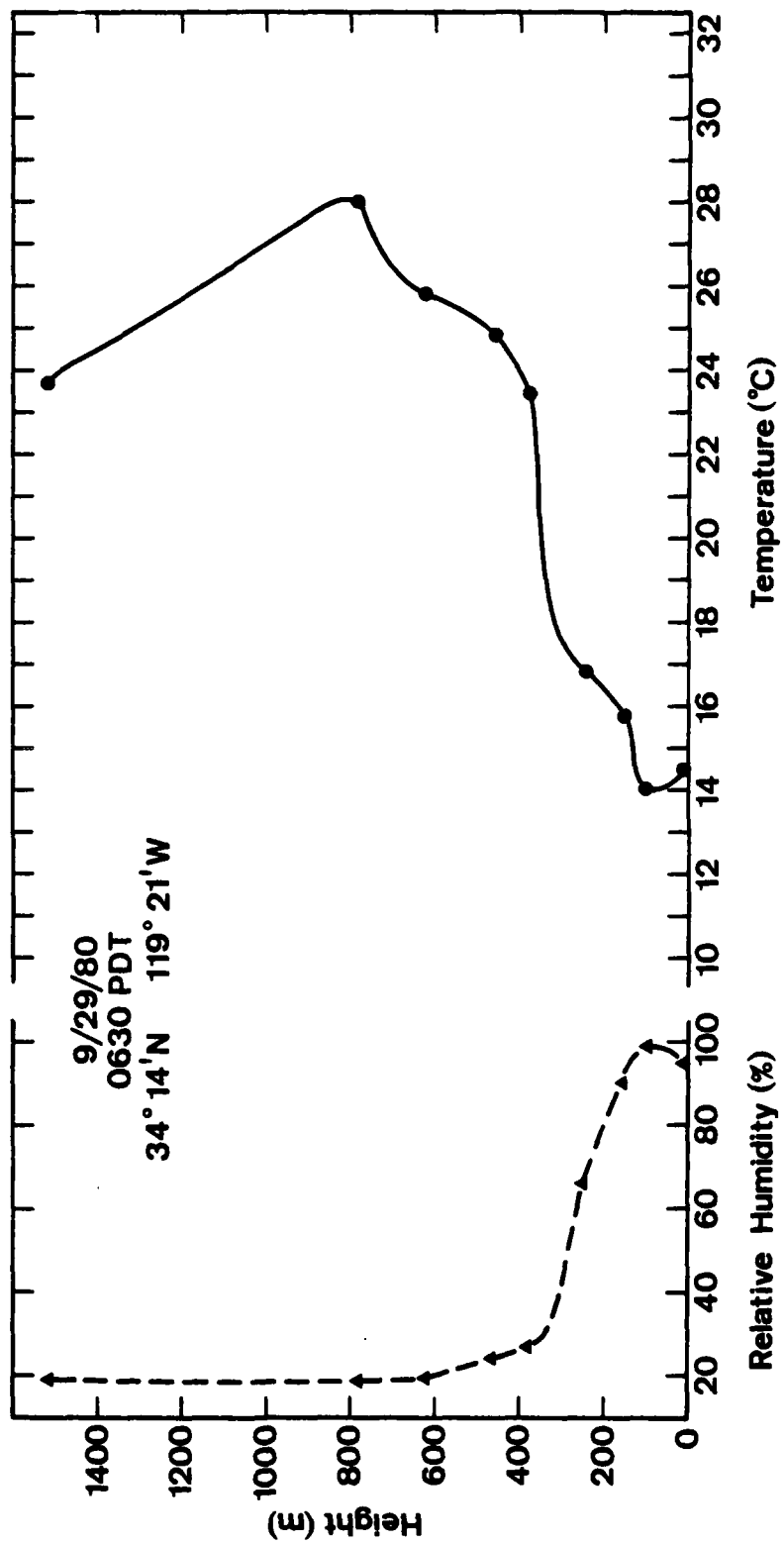


Figure 2m
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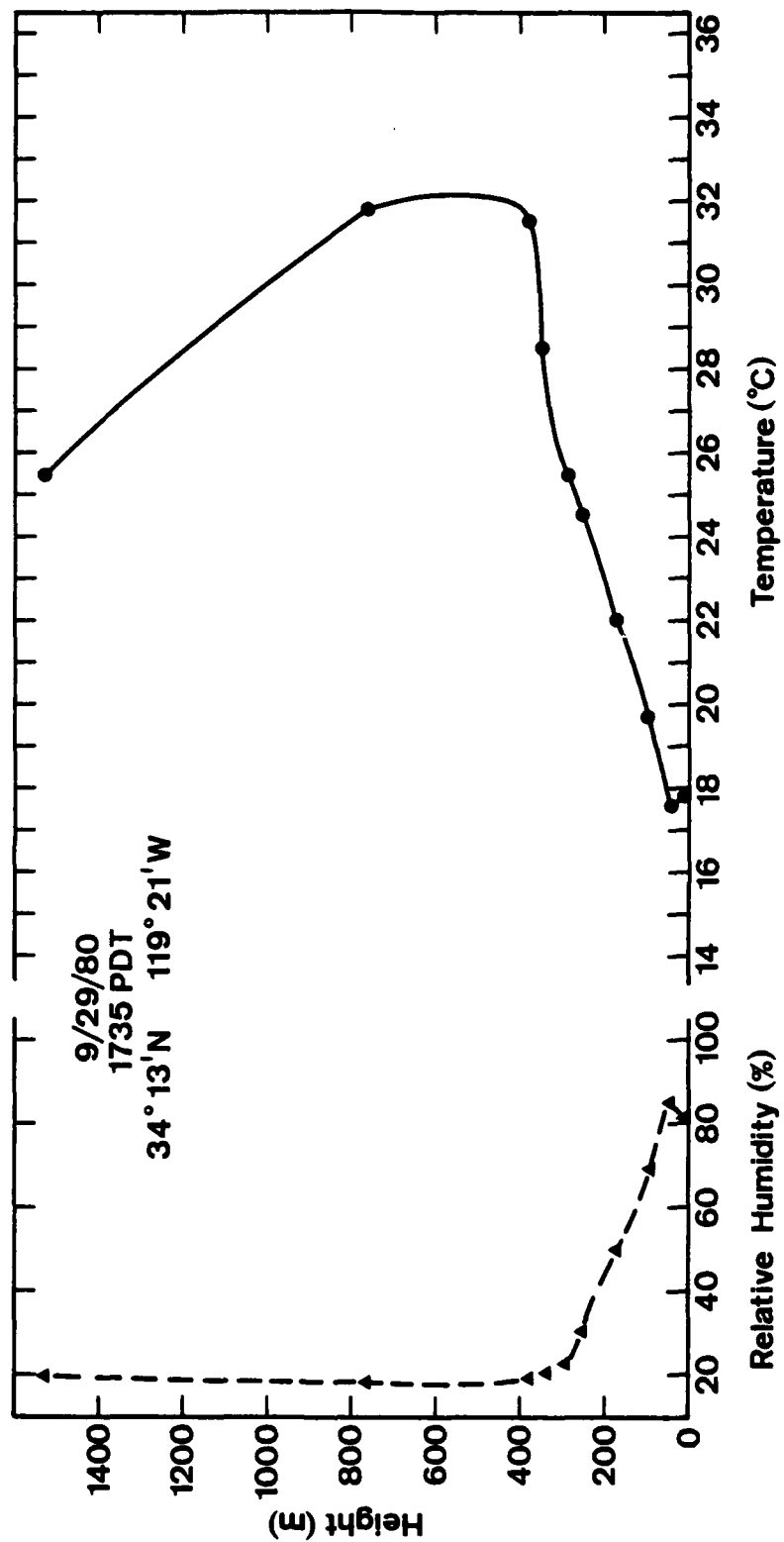


Figure 2n

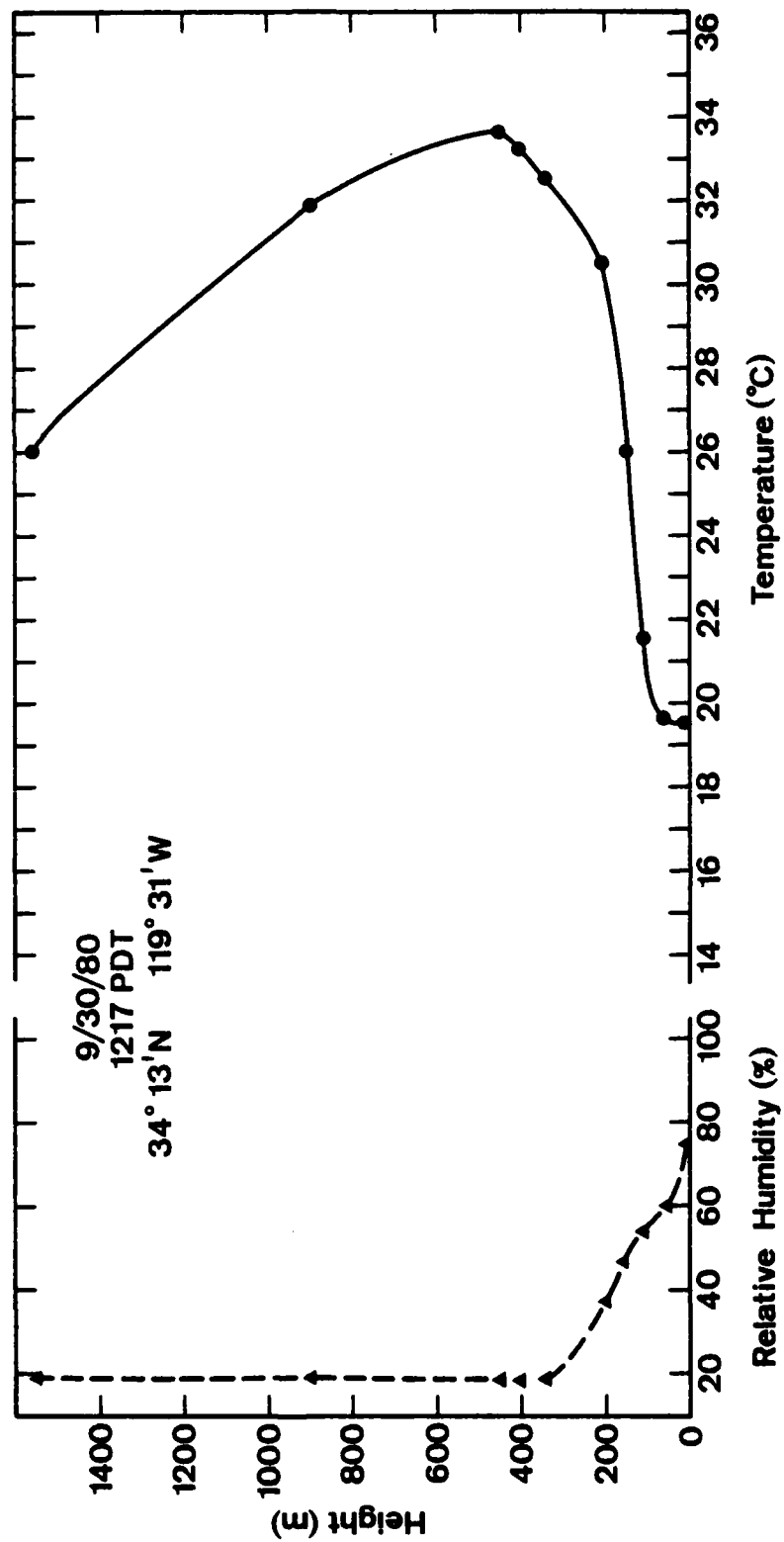


Figure 2o

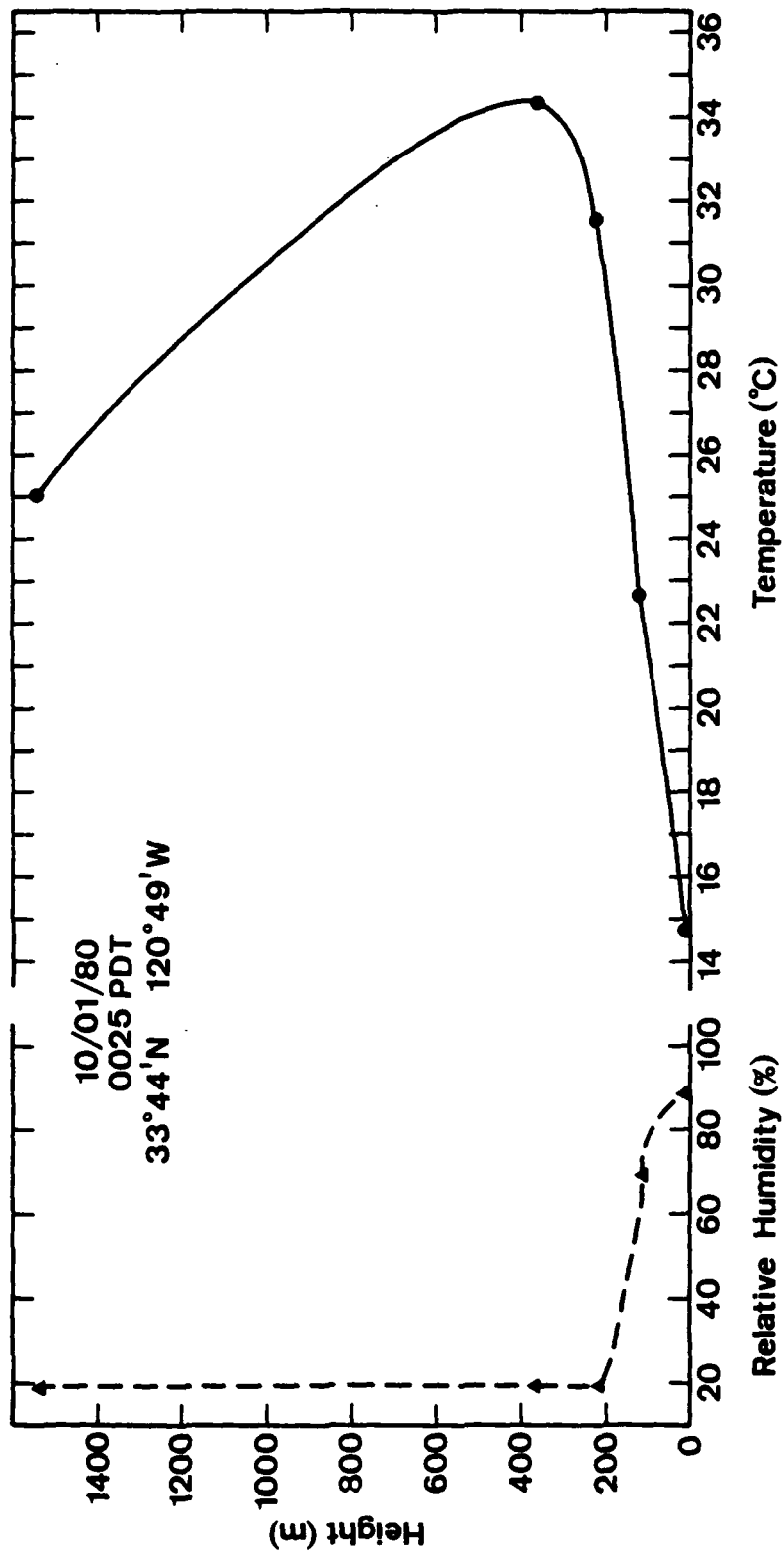


Figure 2p

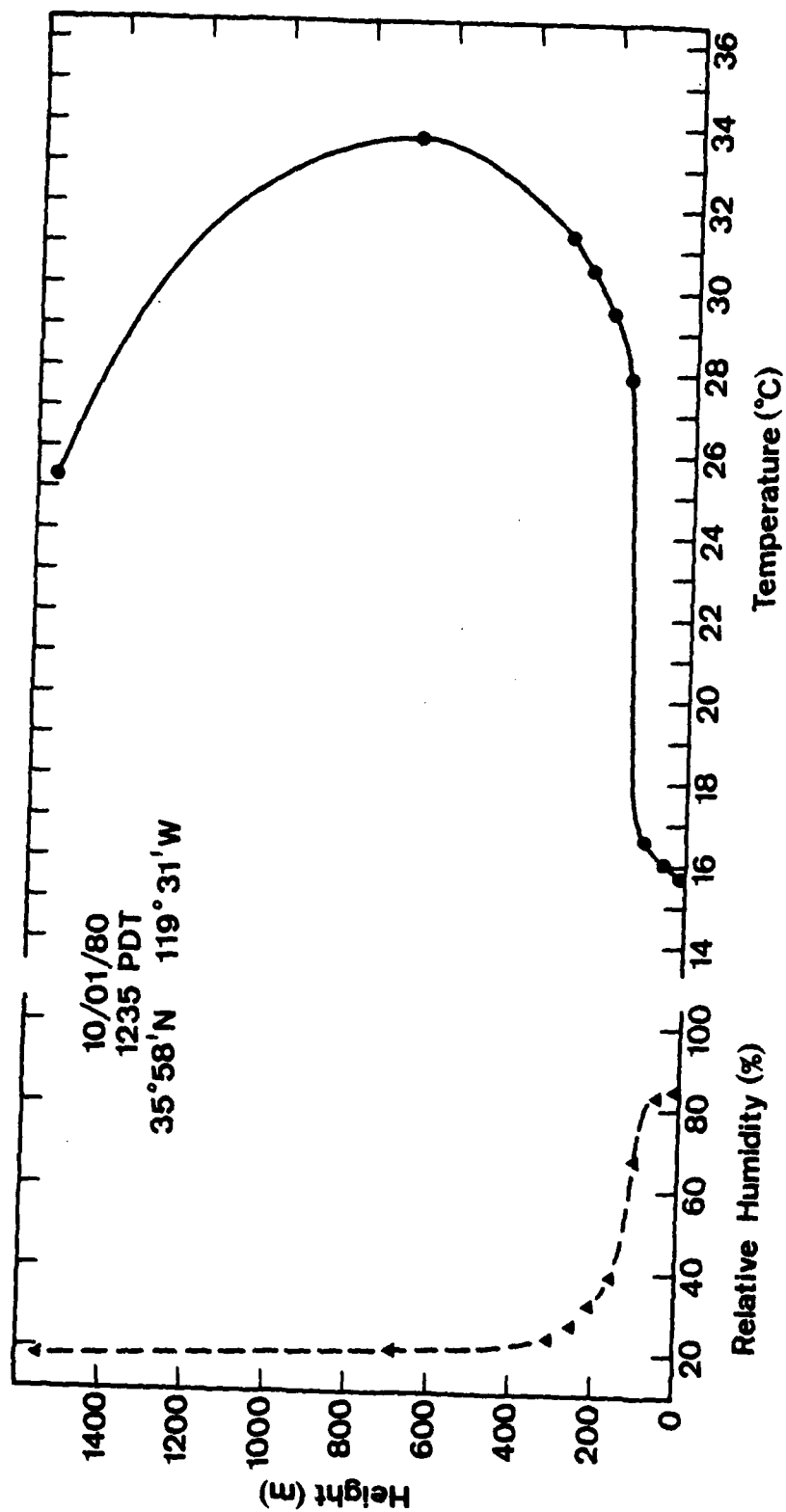


Figure 2q

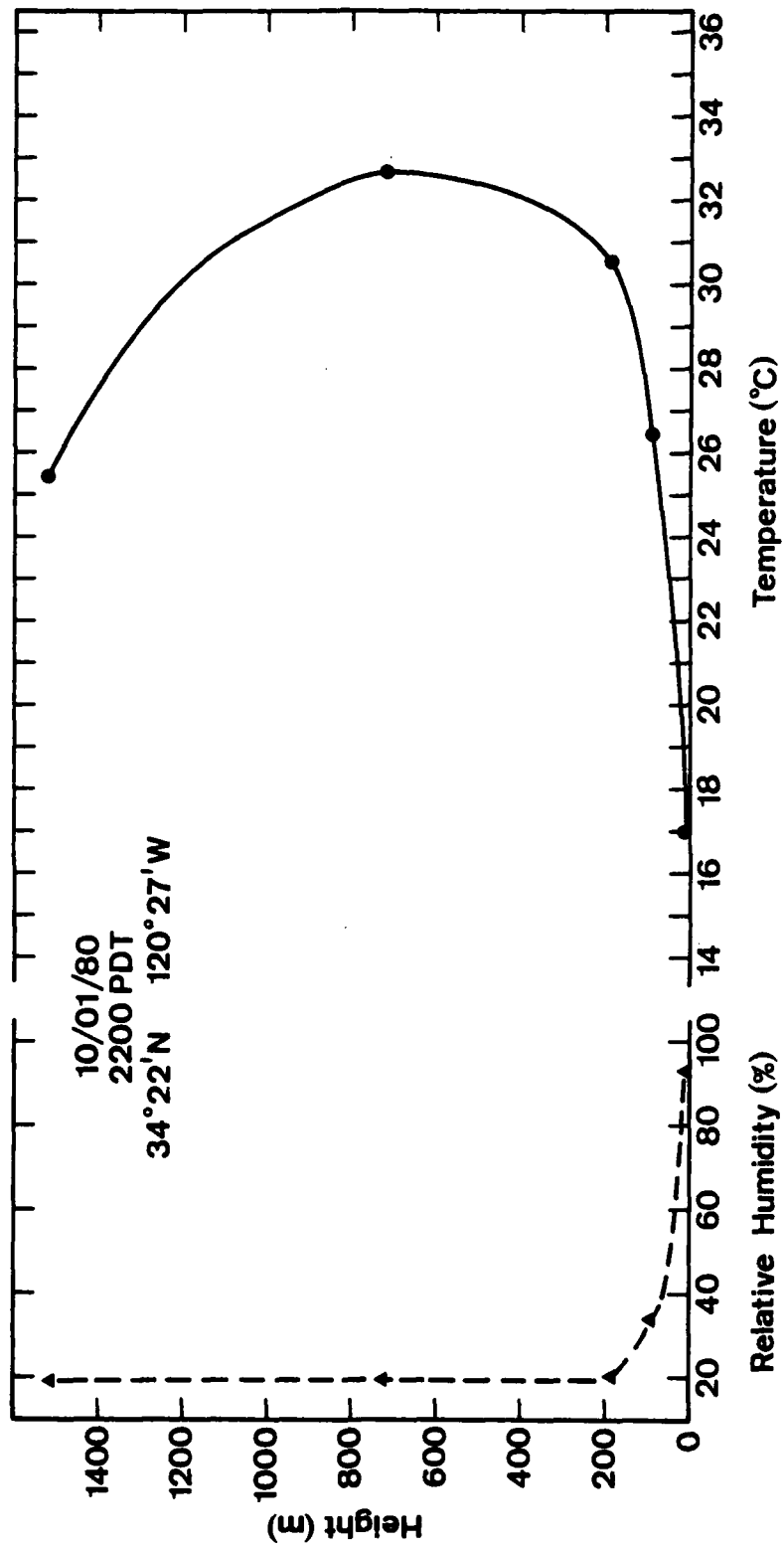


Figure 2r
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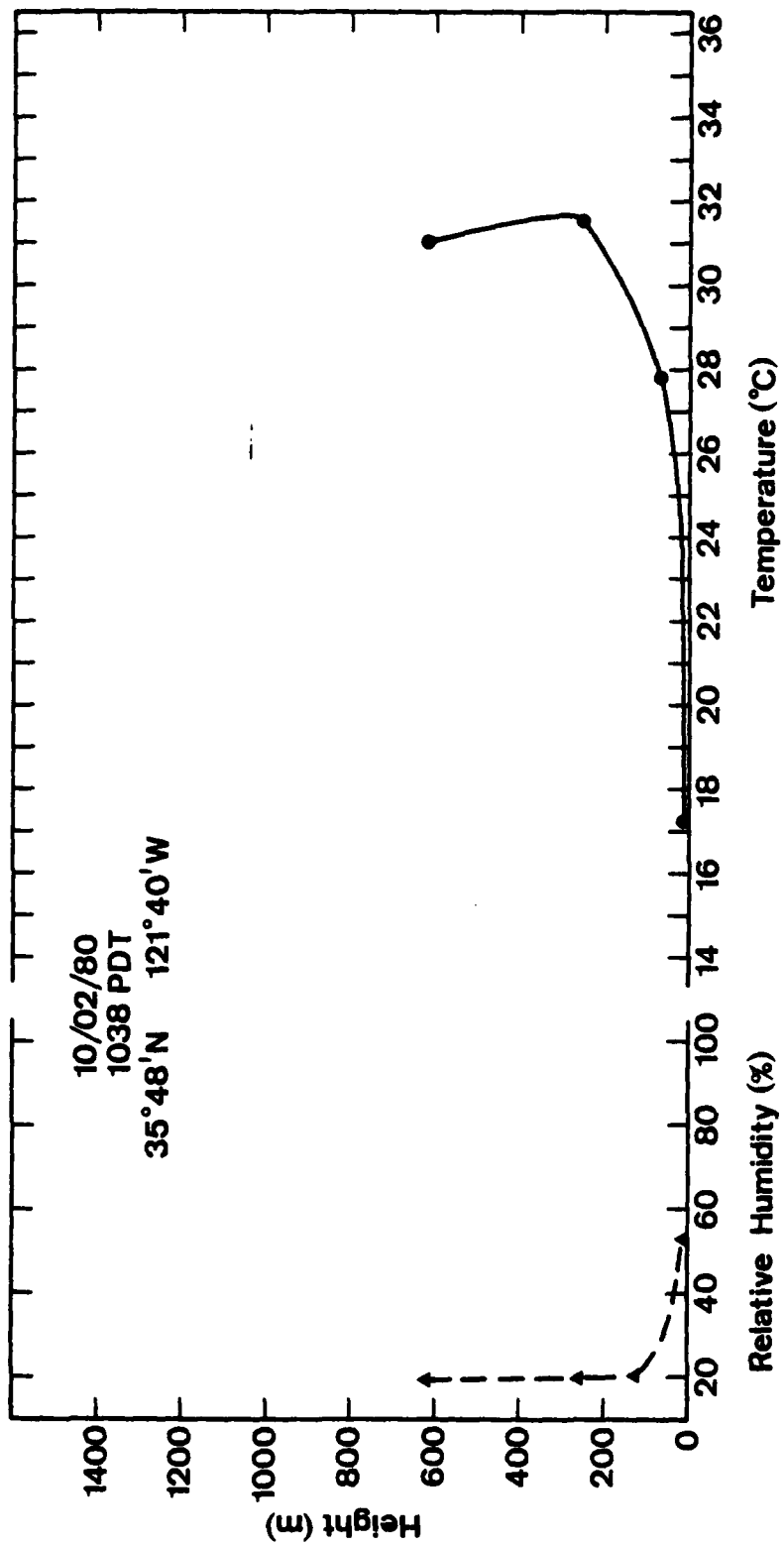


Figure 2s
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VII. Acoustic Sounder Inversion Height

The acoustic sounder was operating on a nearly continual basis throughout the cruise. In Table 5 we list the inversion height as determined from the sounder strip chart output. At times it is difficult to determine the correct height because of multiple layering so more than one height is given. Photographs of the strip charts are shown in Figures 3 as they can greatly aid in determining the boundary layer depth, especially when they are compared with the radiosonde results.

Normally, it is fairly easy to determine the boundary layer depth from acoustical sounder records, especially over the ocean. This was not true for this operation. The ship was near land and the period was during a major smog event. Multiple layering was common and even with radiosonde results it was not always possible to determine the height of the well-mixed layer.



Figure 3a

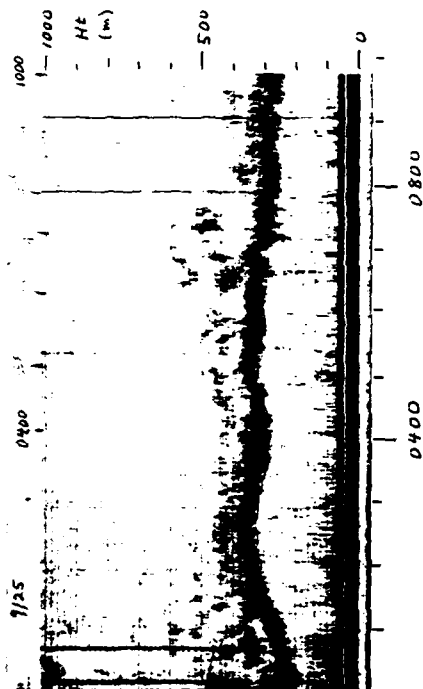
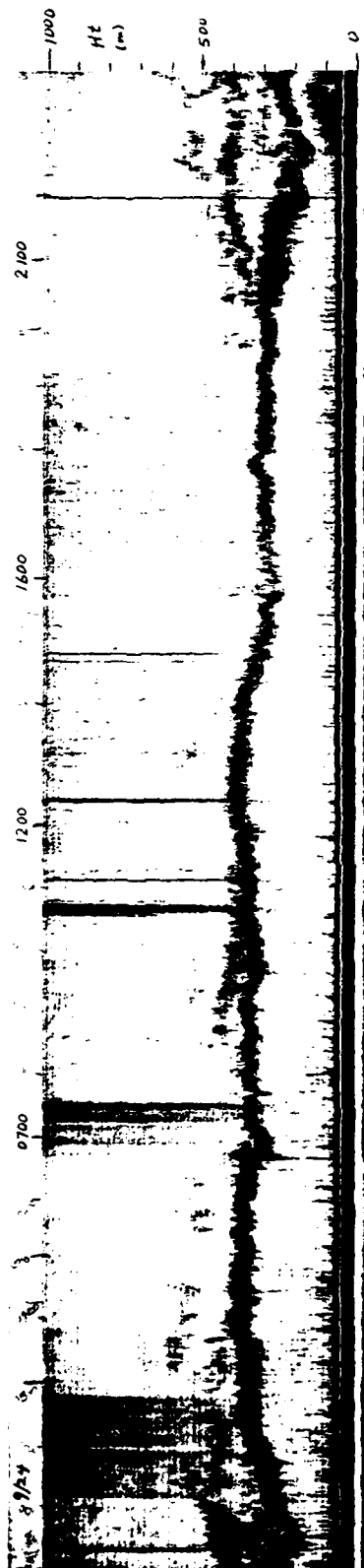


Figure 3b

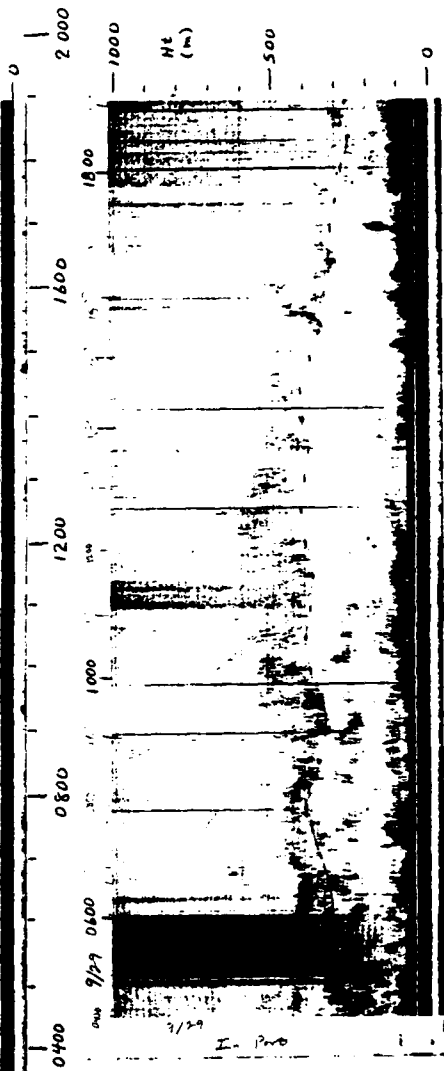
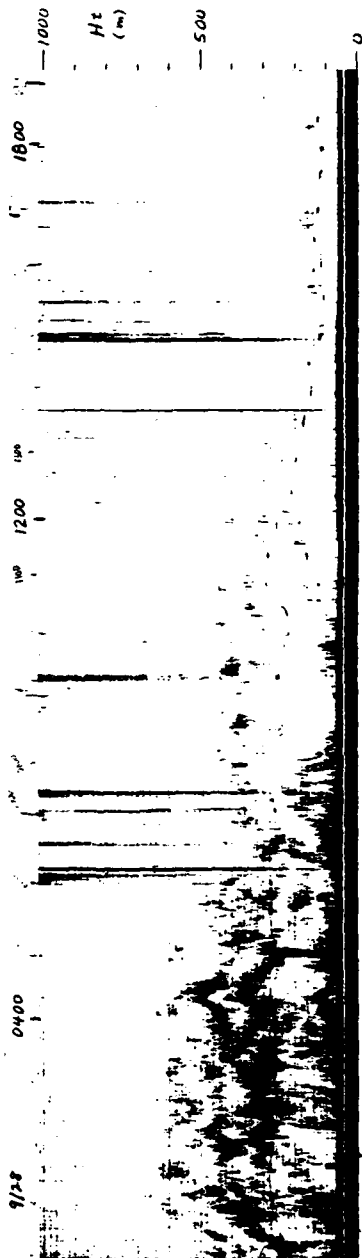
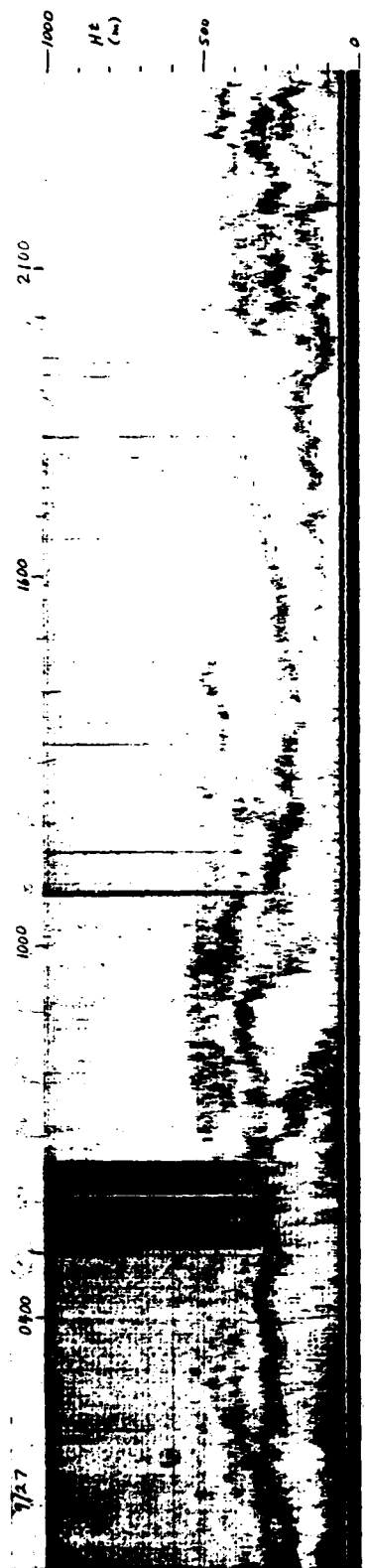


Figure 3c

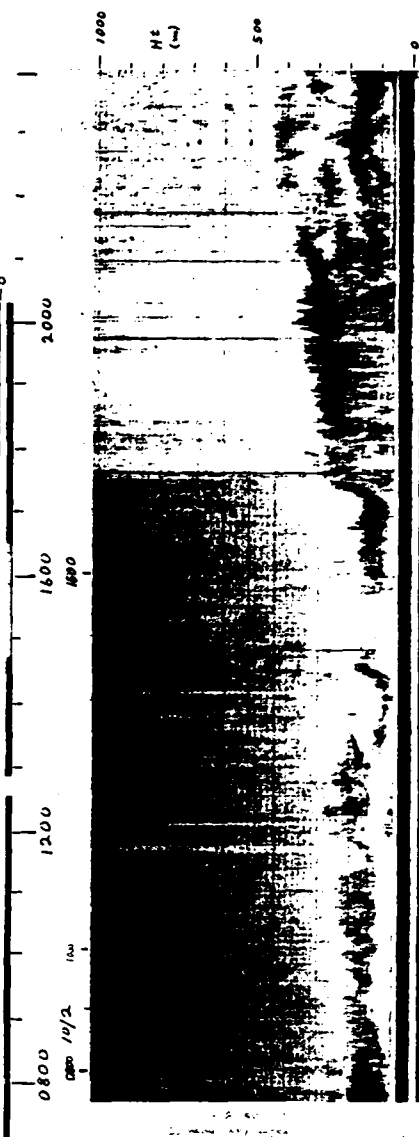
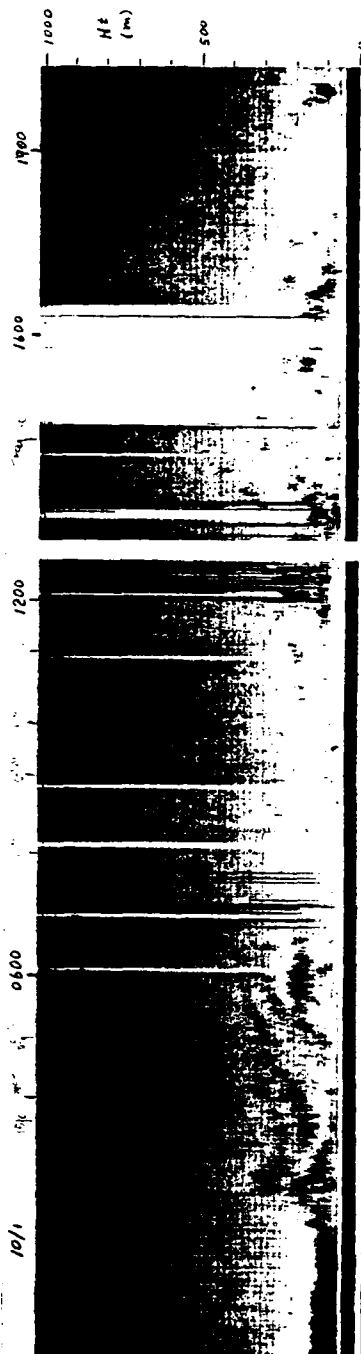
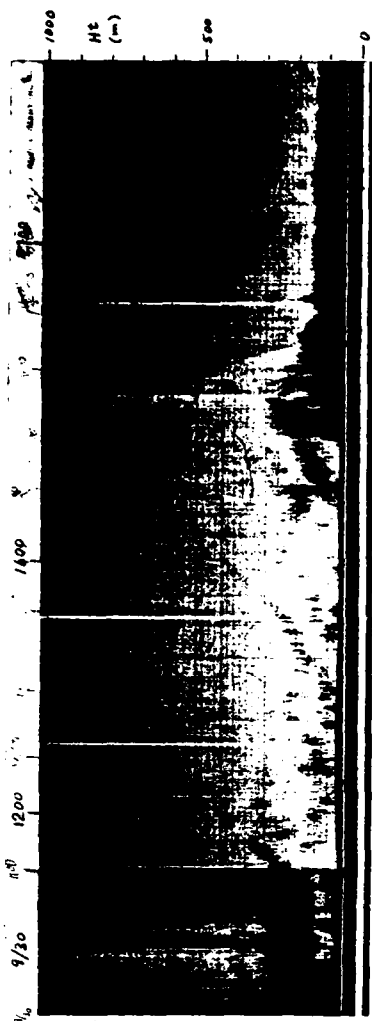


Figure 3d

Table 5. Inversion height as determined from the acoustic sounder. More than one height is listed when multiple layering makes the situation ambiguous.

DATE	TIME	Z (m)		DATE	TIME	Z (m)	
09/21	0900	0		9/22	1700	260	
	1130	0			1730	310	
	1200	90			1800	320	
	1230	120			1830	340	
	1300	100			1900	280	
	1330	70			2000	360	
	1500	60			2030	370	
	1530	70			2100	360	
	1600	70			2130	400	
	1630	0			2200	370	
	1730	0	160		2230	380	
	1800	0	210		2300	300	
	1830	80	260		2330	330	
	1900	120			2400	320	
	1930	180		9/23	0030	340	
	2000	240			0100	340	
	2030	300			0130	330	
	2100	340			0200	320	
	2130	290			0230	310	
	2200	190			0300	320	
	2230	0			0330	330	
	2300	300			0400	320	
	2330	340			0430	310	
	2400	380			0500	320	
9/22	0030	400			0530	330	
	0100	430			0600	310	
	0130	460			0630	320	
	0145	350			0700	300	
	0200	220			0730	320	
	0230	190			0800	310	
	0300	160			0830	340	
	0330	140			0900	330	
	0400	80			0930	340	
	0600	0			1000	320	
	0630	280			1030	310	
	0700	320			1100	330	
	0730	410			1130	340	
	0800	460			1200	350	
	0830	500			1230	360	
	0900	520			1300	370	
	0930	550			1330	350	
	1000	560			1400	330	
	1030	570			1430	310	
	1100	580			1500	320	
	1130	140	580		1530	330	
	1200	230	590		1600	310	
	1400				1630	300	
	1430	220	520		1700	290	
	1500	220	450		1730	280	
	1530	240	410		1800	260	
	1600	210			1830	270	
	1630	270			1900	290	

DATE	TIME	Z (m)		DATE	TIME	Z (m)	
9/23	1930	300		9/24	2130	210	
	2000	290			2200	170	
	2030	310			2230	160	
	2100	300			2300	180	
	2130	240			2330	200	
	2200	210					
	2230	200		9/25	0000	220	
	2300	180			0030	210	
	2330	200			0100	230	
					0130	290	
9/24	0000	210			0200	310	
	0030	190	390		0230	330	
	0100	230			0300	320	
	0130	250			0330	300	
	0200	270			0400	290	
	0230	300			0430	300	
	0300	310			0500	320	
	0330	320			0530	310	
	0400	340			0600	300	
	0430	320			0630	290	
	0500	330			0700	240	
	0530	340			0730	270	
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	0630	310			0830	270	
	0700	290			0900	260	
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	1430	310			1630	270	
	1500	280			1700	280	
	1530	270			1730	290	
	1600	250			1800	300	
	1630	270			1830	320	
	1700	280			1900	330	
	1730	270			1930	310	
	1800	280			2000	240	330
	1830	270			2030	250	
	1900	280			2100	220	
	1930	270			2130	240	
	2000	260			2200	220	
	2030	240			2230	210	
	2100	220					

DATE	TIME	Z (m)		DATE	TIME	Z (m)	
9/27	0000	200		9/28	0200	280	
	0100	210			0230	250	
	0130	220			0300	260	
	0200	250			0330	270	
	0230	240			0400	260	
	0300	260			0430	270	
	0330	250			0500	250	
	0400	260			0530		
	0430	270			0600		
	0500	250			0630	200	
	0530	270			0700		
	0600	270			0730		
	0630	290			0800		
	0700	200			0830		
	0730	180	280		0900		
	0800	300	400		0930	250	
	0830	330	440		1000	230	
	0900	340	450		1030	240	
	0930	280	400		1100	300	
	1000	160	380		1130	290	
	1030	180	380		1200	260	
	1100	240			1230	210	
	1130	230			1300	200	
	1200	210			1330	170	
	1230	240			1400	150	
	1300	230			1430	160	
	1330	210			1500	120	
	1400	200			1530	110	
	1430	210			1600	120	
	1500	140	230		1630	140	
	1530	130	240		1700	130	
	1600	110	250		1730	120	
	1630	120	270		1800	110	
	1700	110	290		1830	130	
	1730	130	340		1900		
	1800	140	360				
	1830	150					
	1900	160					
	1930	120					
	2000	100					
	2030	110	220				
	2100	90	230				
	2130	220	250				
	2200	240	260				
	2230	230	270				
	2300	250	290				
	2330	200	280				
9/28	0000	200			0430	240	
	0030	280			0500	200	280
	0100				0530	240	
	0130				0600	310	
	0200	280			0630	320	
					0700	350	
					0730	380	
					0800	390	
					0830	360	

DATE	TIME	Z (m)		DATE	TIME	Z (m)	
9/29	0900	340		10/2	2030	240	
	0930	360			2100		
	1000	380			2130		
	1030	80	400		2200	110	
	1100	380			2230	140	
	1130	80	370		2300	150	
	1200	400			2330	130	
	1230	410					
	1300	100	400				
	1330	80	390				
	1400	410		10/3	0000	120	
	1430	420			0030	110	
	1500	380			0100	90	
	1530	340			0130	110	
	1600	330			0200	100	
	1630	310			0230	130	
	1700	320			0300	140	
	1730	300			0330	150	
	1800	280			0400	170	
	1830	260			0430	160	
	1900	270			0500	120	
9/30	No well	defined			0530	140	
10/1	Inver	sion			0600	120	
					0630	130	
					0700	140	
					0730	100	
					0800	90	
10/2	0800	90					
	0830	110					
	0900	140					
	0930	130					
	1000	110					
	1030	120					
	1100	130					
	1130	140					
	1200	150					
	1230	140					
	1300	190					
	1330	120					
	1400	90					
	1430	100					
	1500	110					
	1530						
	1600	100					
	1630	110					
	1700	80					
	1730						
	1800						
	1830	220					
	1900	230					
	1930	220					
	2000	230					

VIII. Meteorological Data

Table 6 presents the basic meteorological data and calculated parameters. Only data taken during the tracer gas release periods are included. Wind speed, relative humidity, and air temperature values are those measured at the upper level (20.5 m). All calculated parameters were determined using the bulk aerodynamic method.

The boundary layer mixing rate and mixing height depend on the boundary layer depth, z_i . We have already mentioned the difficulty in determining the depth for these data. On the 28th and 29th we could not determine if the depth of the well-mixed region was 100 or 400 m, which makes the mixing rate and time calculations ambiguous. The results shown are self consistent.

Table 6. Meteorological Data

BLM #1-80
Release #1

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10 ⁴ *Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/24 1137	2.1	73	14.7	16.6	330	0.073	0.075	107.0	-2.38E 00	0.4	14.0
09/24 1205	2.1	74	14.6	16.8	360	0.073	0.082	115.1	-2.55E 00	0.4	14.3
09/24 1233	2.0	73	14.9	16.9	350	0.068	0.075	107.5	-2.78E 00	0.4	14.9
09/24 1301	2.3	73	15.1	16.8	350	0.078	0.066	97.4	-1.91E 00	0.4	14.8
09/24 1329	1.9	72	15.0	16.9	340	0.065	0.073	105.9	-2.97E 00	0.4	14.9
09/24 1357	2.8	68	15.1	17.3	330	0.093	0.084	121.8	-1.67E 00	0.4	12.4
09/24 1425	3.9	70	15.2	17.3	300	0.131	0.075	108.5	-7.46E-01	0.5	10.8
09/24 1453	3.9	72	15.3	17.3	280	0.133	0.070	102.6	-6.87E-01	0.4	10.4
09/24 1521	3.6	71	15.2	17.3	260	0.123	0.075	108.7	-8.54E-01	0.4	10.0
09/24 1549	4.6	72	15.1	17.2	240	0.156	0.074	105.9	-5.13E-01	0.5	8.8
09/24 1617	5.9	76	15.0	17.1	250	0.206	0.071	98.8	-2.75E-01	0.5	8.3
09/24 1645	6.4	79	15.0	16.9	260	0.225	0.065	89.2	-2.09E-01	0.5	8.6
09/24 1713	5.8	76	14.8	16.8	270	0.200	0.068	94.5	-2.79E-01	0.5	9.0
09/24 1741	6.6	78	16.5	18.6	290	0.231	0.070	97.8	-2.17E-01	0.5	8.9
09/24 1809	7.0	79	14.8	16.7	290	0.243	0.061	25.1	-5.25E-02	0.5	9.2
09/24 1837	7.0	76	14.9	17.0	280	0.247	0.069	95.9	-1.86E-01	0.5	8.5
09/24 1905	6.8	77	14.8	16.9	280	0.239	0.071	97.4	-2.02E-01	0.5	8.5

BLM #1-80
Release #2

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10 ³ *Qo (m/sect)	z/L	w* (m/sec)	t (min)
09/27 0715	2.8	85	13.1	16.9	300	0.096	0.156	187.3	-2.39E 00	0.5	9.3
09/27 0743	2.8	87	12.9	16.9	250	0.096	0.164	194.5	-2.51E 00	0.5	8.2
09/27 0859	2.9	80	14.1	16.9	340	0.098	0.109	138.9	-1.71E 00	0.5	11.4
09/27 0945	4.6	78	14.5	17.0	200	0.156	0.087	115.3	-5.61E-01	0.5	7.4
09/27 1013	3.9	80	14.8	17.1	380	0.132	0.082	108.9	-7.44E-01	0.5	12.2
09/27 1041	4.1	80	15.0	17.1	400	0.138	0.076	103.0	-6.41E-01	0.5	12.7
09/27 1138	5.1	80	15.1	17.1	230	0.175	0.071	96.1	-3.71E-01	0.5	8.3
09/27 1206	5.1	82	14.8	17.2	220	0.175	0.084	109.2	-4.20E-01	0.5	7.6
09/27 1234	5.5	83	15.0	17.2	200	0.190	0.078	101.7	-3.35E-01	0.5	7.2
09/27 1302	5.9	82	15.0	17.2	220	0.207	0.075	98.8	-2.74E-01	0.5	7.5
09/27 1330	6.4	81	15.3	17.2	210	0.226	0.064	87.6	-2.04E-01	0.5	7.5
09/27 1358	6.6	77	15.5	17.1	200	0.229	0.054	79.7	-1.80E-01	0.4	7.6
09/27 1426	7.6	80	15.6	17.1	200	0.270	0.050	73.2	-1.19E-01	0.5	7.4
09/27 1454	8.3	77	15.8	17.2	180	0.298	0.042	66.3	-8.84E-02	0.4	7.0
09/27 1522	8.9	77	15.9	17.1	220	0.337	0.036	59.2	-6.18E-02	0.4	8.2
09/27 1550	8.0	75	16.2	17.1	230	0.284	0.025	48.4	-7.06E-02	0.4	10.0
09/27 1618	7.8	75	16.4	17.1	260	0.274	0.018	41.2	-6.45E-02	0.4	12.2
09/27 1646	7.9	77	16.4	17.0	290	0.277	0.017	38.3	-5.87E-02	0.4	13.3
09/27 1714	7.4	80	16.2	17.0	310	0.257	0.022	41.3	-7.37E-02	0.4	13.2
09/27 1742	8.0	80	16.0	17.0	140	0.282	0.028	48.5	-7.23E-02	0.3	6.9
09/27 1810	7.0	80	16.0	17.0	140	0.243	0.030	50.1	-1.00E-01	0.3	7.2
09/27 1838	5.8	80	15.9	16.9	160	0.200	0.029	49.6	-1.47E-01	0.3	8.4
09/27 1906	5.6	80	15.9	16.9	160	0.192	0.029	49.3	-1.58E-01	0.3	8.5

BLM #1-80
Release #3

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10 ³ *Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/28 1307	2.0	81	15.8	17.1	210	0.067	0.045	68.0	-1.77E 00	0.3	12.6
09/28 1335	2.3	81	15.9	17.2	200	0.076	0.046	70.0	-1.43E 00	0.3	11.6
09/28 1408	2.9	81	16.0	17.3	160	0.094	0.046	69.1	-9.35E-01	0.3	9.3
09/28 1436	2.5	82	16.1	18.1	160	0.084	0.077	104.0	-1.74E 00	0.3	8.1
09/28 1504	3.0	83	16.2	18.0	400	0.100	0.065	90.5	-1.08E 00	0.4	15.0
09/28 1532	3.5	83	16.4	18.1	120	0.116	0.060	84.3	-7.41E-01	0.3	6.5
09/28 1600	3.4	81	16.6	18.0	140	0.111	0.046	70.1	-6.72E-01	0.3	8.0
09/28 1628	3.3	80	16.8	17.8	140	0.106	0.029	50.8	-5.32E-01	0.2	9.6
09/28 1740	3.1	80	16.9	17.8	400	0.102	0.029	51.1	-5.82E-01	0.3	19.5
09/28 1808	3.5	80	16.8	17.8	110	0.114	0.030	53.3	-4.85E-01	0.2	7.8
09/28 1836	2.7	81	16.6	17.6	400	0.088	0.031	52.9	-8.08E-01	0.3	20.0
09/28 1904	2.3	81	16.6	17.5	400	0.075	0.032	54.5	-1.15E 00	0.3	20.8

BLM #1-80
Release #4

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10 ³ *Qo (m/second)	z/L	w* (m/sec)	t (min)
09/29 1217	2.4	80	13.8	16.1	100	0.079	0.090	117.0	-2.20E 00	0.3	5.8
09/29 1245	2.2	78	14.6	16.1	400	0.072	0.052	76.9	-1.76E 00	0.4	18.0
09/29 1319	2.7	76	15.4	16.2	440	0.087	0.027	50.3	-7.80E-01	0.3	22.5
09/29 1347	3.3	76	15.6	16.3	400	0.106	0.024	46.4	-4.85E-01	0.3	20.6
09/29 1415	3.5	76	15.7	16.5	430	0.114	0.024	46.7	-4.26E-01	0.3	21.1
09/29 1443	4.0	76	15.9	16.6	440	0.129	0.018	40.5	-2.85E-01	0.3	22.3
09/29 1511	4.7	76	16.1	16.3	410	0.154	0.000	19.5	-9.64E-02	0.1	91.9
09/29 1540	5.5	76	16.1	15.9	360	0.179	-0.011	6.6	-2.32E-02	0.3	20.8
09/29 1626	4.8	76	16.0	16.0	300	0.154	-0.006	11.9	-5.76E-02	0.2	23.3
09/29 1654	4.6	76	16.1	16.0	320	0.149	-0.008	10.0	-5.17E-02	0.2	22.7
09/29 1722	4.9	76	16.0	16.1	310	0.162	-0.002	17.3	-7.72E-02	0.1	37.5
09/29 1750	5.4	76	15.9	16.1	320	0.180	0.002	21.8	-7.87E-02	0.2	31.4
09/29 1818	5.1	76	15.8	16.0	280	0.169	0.002	20.9	-8.62E-02	0.1	32.5
09/29 1846	4.5	76	15.7	15.9	260	0.146	0.003	22.0	-1.20E-01	0.2	28.1
09/29 1902	4.3	76	15.8	15.9	280	0.137	-0.001	18.0	-1.13E-01	0.1	50.2

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